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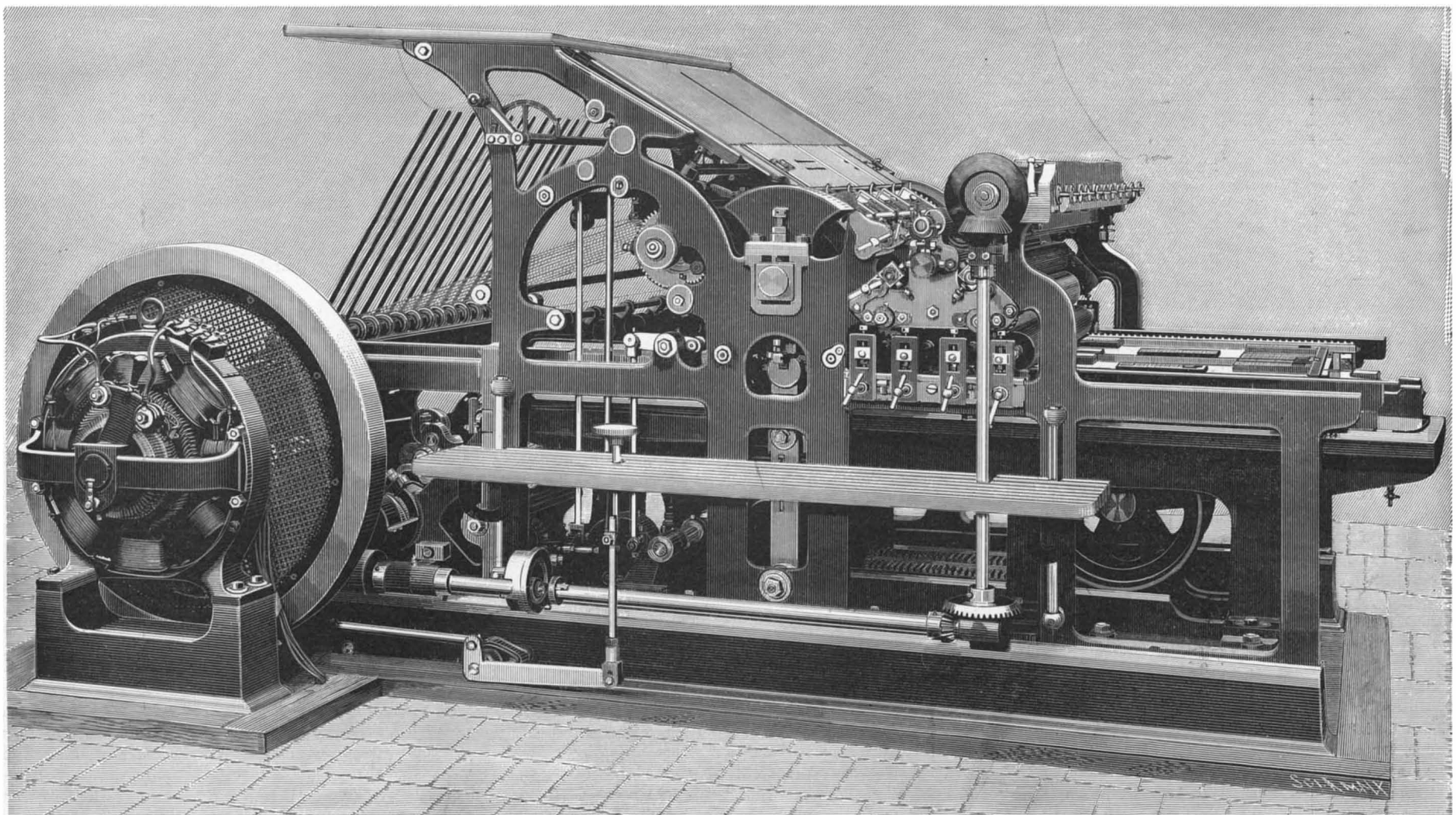
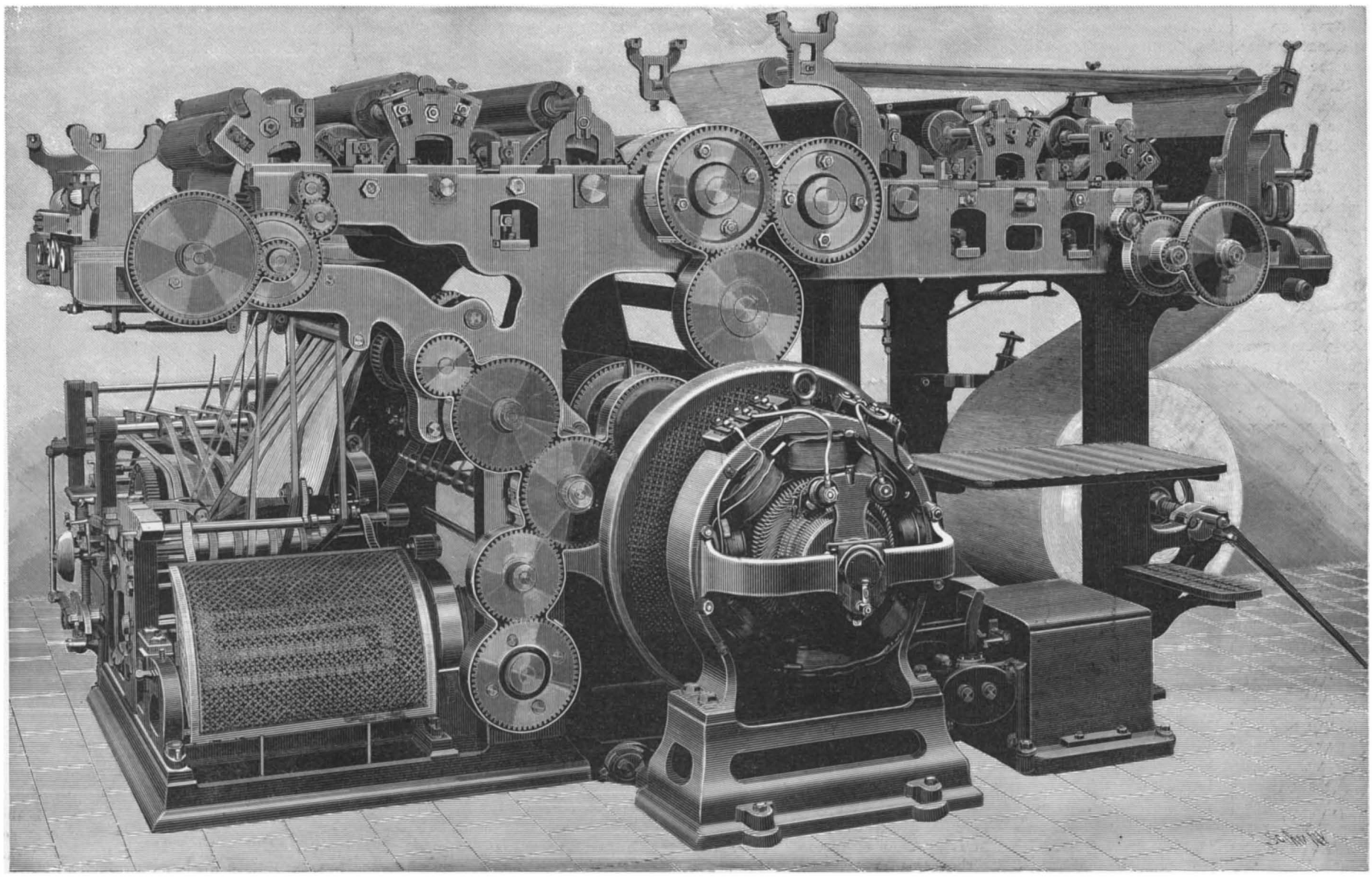
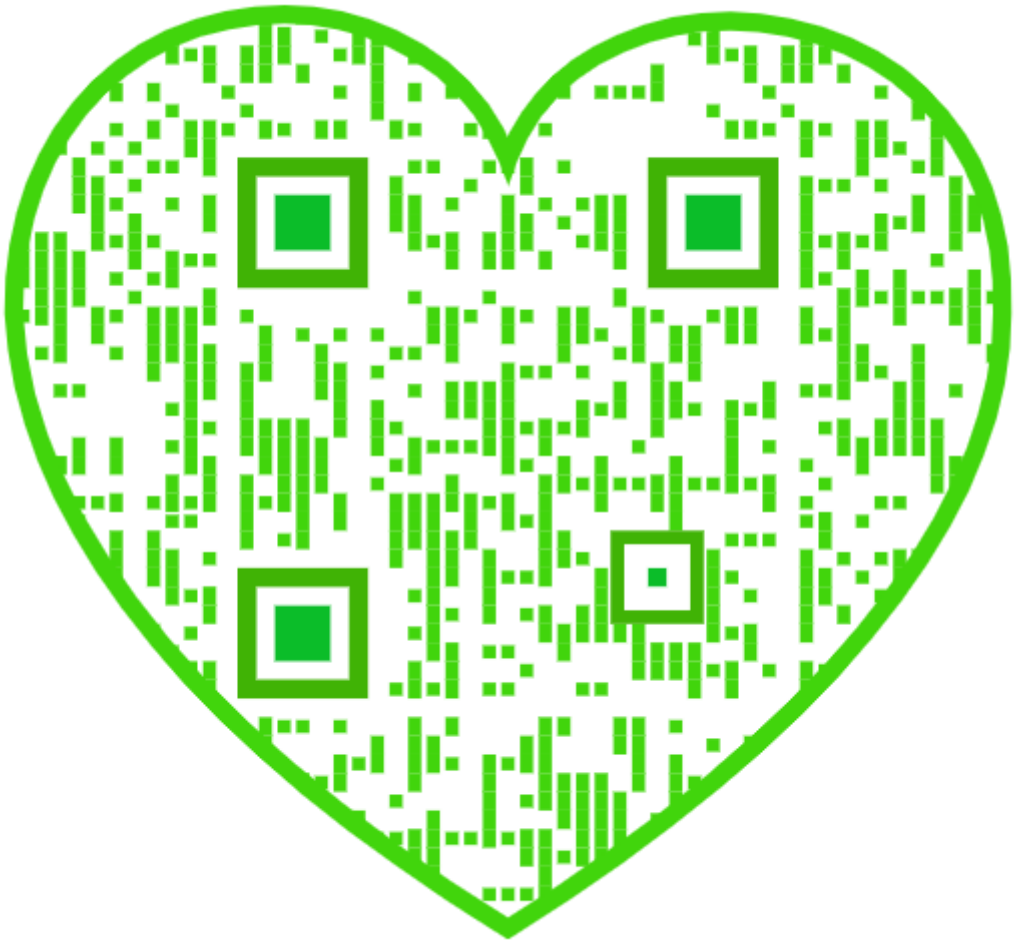


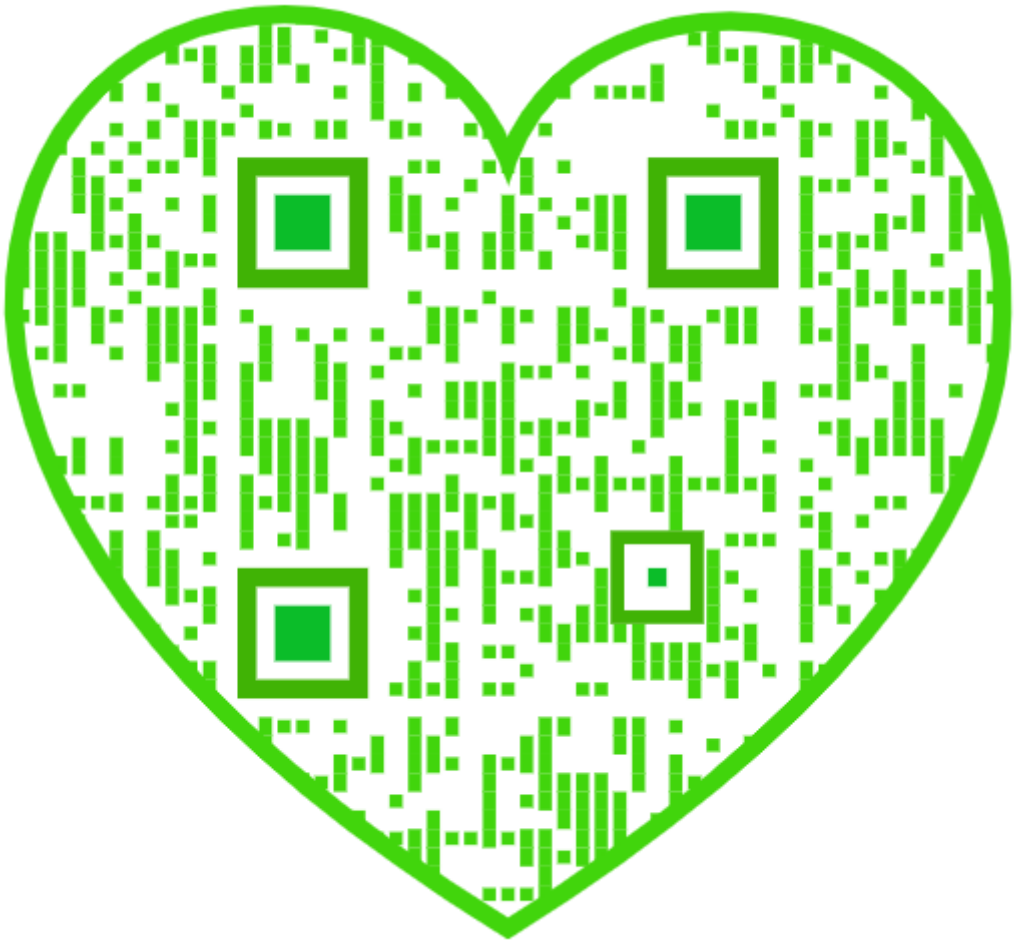
High-Speed Press Driven by Direct-Current Motor.



Motor Direct-Connected to a German High-Speed Rotary Press.

THE MODERN USES OF ELECTRICITY IN PRINTING.—[See page 415.]





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NEW YORK, SATURDAY, JUNE 14, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

NAVAL BUREAU CHIEFS AND THE SUBMARINE BOAT.

The submarine is one of those devices which have suffered from the zeal of its friends, and the naval world is just now experiencing the first stages of that reaction of sentiment which was bound to follow, sooner or later, as the result of the terms of exaggerated praise in which the submarine has been spoken of, and the claims for unlimited powers of destruction which have been made for it.

Although the submarine has always been more or less in the air, if we may use such a phrase, it was not until the last decade of the nineteenth century, when the French navy began its series of elaborate and very thorough experiments, that the type was brought into the extraordinary prominence which it now holds. To the naturally sanguine Gallic temperament the performance of the "Narval" and her sisters presented a great opportunity for doubling the offensive and defensive power of the French navy at a stroke and for a relatively small outlay of money. England, it was argued, might add battleship to battleship and cruiser to cruiser, at a cost of four or five million dollars a ship, but of what avail was it when France, for an expenditure of a tenth part of that sum per vessel, could people her own and the enemy's harbors and roadsteads with a swarm of death-dealing underwater craft. In the enthusiasm of the new movement it was natural for newspaper correspondents, more or less, and generally less, qualified to write on naval matters, to magnify every performance and minify every defect of the new craft.

Ultimately the submarine fever reached this country, with the result that we have now some seven or eight of these boats, built or building; and even Great Britain, skeptical as she has always professed to be of the value of the submarine, has now under construction some half dozen, two or three of which have by this time been launched and tried. Germany, indeed, seems to be the only first-class naval power that has steadily refused to be drawn into submarine construction. She has none afloat, nor have any been authorized.

It was only a question of time when the inherent, and what would almost seem to be the ineradicable, defects of the submarine would become clearly manifest; and to-day we can see a marked reaction from the temporary extravagant favor with which they have been regarded. It is but fair to say, just here, that the Naval Board of Construction has always been very conservative in its attitude toward the submarine; and its members, collectively and individually, have always urged that we move slowly in adopting a device so radical and largely untried. The fact that we have half a dozen submarines already in the navy is due to the desire of Congress to have some of these vessels included in our fleet. For purposes of experiment and further improvements, perhaps, it is as well that we possess them; but when it comes to a question of building thirty additional submarine boats of the Holland type, as is proposed in the bill before the House, it is certainly time for someone who has technical knowledge and authority to call a halt. This has been done by several of the Chiefs of the Bureaus who are opposed to the purchase at this time of any more of these craft. Rear-Admiral O'Neil, Chief of the Bureau of Naval Ordnance, refers to his opinion on submarine boats in general, expressed by him over a year and a half ago, and he states that he still regards them as experimental craft, whose utility for efficient service has yet to be demonstrated. He considers that the Holland boat does not fulfill all the necessary requirements of a successful instrument of warfare; and he furthermore believes that the whole science of submarine navigation is yet in its infancy, and has not even passed the experimental stage. What we have now to do is to develop submarine boats having fewer limitations than the Holland boats, and this the Admiral thinks can only be done by throwing the door open to other inventors. Nothing more is needed at present than that the government give such encouragement as will awaken interest in the subject, and induce competition among designers and builders in the production of the best craft of the type.

Another strongly dissenting voice is that of Rear-Admiral Bowles, Chief of the Bureau of Construction and Repair, who has submitted a written suggestion to the effect that "the Secretary of the Navy be authorized to procure four or more submarine boats of the most approved design, either by purchase or by construction under contract, or in navy yards, provided that not more than one of these boats shall be procured from or built upon designs of the same individual or company." It is furthermore suggested that before purchasing or contracting for any boat, the Secretary of the Navy must be satisfied that such a boat is, or will be, more effective as a weapon of war than any of the submarine boats heretofore procured or now under construction for the navy. It is proposed that a sum of five hundred thousand dollars be appropriated for this purpose.

The wisdom of the course outlined by these two Chiefs of Bureaus is obvious. The statement of Admiral O'Neil to the effect that the submarine has not yet left the experimental stage, is fully borne out by such tests as have been made with our naval boats of the Holland type; and we therefore sincerely hope that Congress will pass a bill embodying the suggestions made by the Chief Constructor. In speaking of the present submarine as experimental, it is not necessary to particularize. If asked to do so, we would refer to the one important fact that all submarines are "blind." When at the surface, the craft can see; but when it is submerged to its working condition, it is as impossible for the craft to see as it is for it to be seen by the enemy. Among the many problems awaiting complete solution in the submarine, this one of "blindness" is certainly the first. If the bill suggested by the Bureau Chiefs be passed, we venture to say that the experimenting that will follow both by naval men and civilians will be directed first and last to this most crucial point.

A DARING INVESTIGATION OF MONT PELEE.

Interesting reports come to us from Martinique. Prof. Angelo Heilprin, president of the Philadelphia Geographical Society, who has made two ascents of Mont Pelée, has just made known the results of his investigations. Several important discoveries have been made which throw light on the nature of the eruption, and which expose many of the wild exaggerations that always follow a terrible catastrophe. The first ascent of the mountain was made on May 31, and the second on June 1. On the first expedition, when the edge of the old crater was reached, the party was overtaken by a terrific thunderstorm. Clouds of rain and steam from the volcano so completely enveloped them that they were able to see only a few feet. Further progress was impossible, for on account of the electrical disturbances their compass refused to work, varying as much as twenty degrees to the eastward. With great difficulty they groped their way down the steep ridge, slipping at every step; for the rain-soaked ashes afforded a precarious footing and threatened to hurl them down the yawning gulfs at each side. The terrific detonations heard were supposed to be of volcanic and not electrical origin, for when the River Fallaise was reached it was found to be filled with steam and mud indicating a fresh volcanic disturbance. The party reached Acier, caked with mud and much disappointed. However, on the next morning, Prof. Heilprin was ready for another encounter with Mont Pelée. We cannot but admire the bravery and devotion of this man who, with his followers, twice climbed the angry volcano and who once, by a sudden dash during a lift in the clouds of vapor, reached the very lip of the crater, from which point stones could be dropped into the white-hot mass, 200 feet below. Standing on the very brink of the crater, he was witness of a most awful, yet fascinating scene. As was to be expected, the principal output of the crater was steam, and but for a favorable shift in the vapor clouds the party could not have made the valuable observations that they did. So far as known, steam is always found in volcanoes, and seems to be the main cause of the eruption. Scientists divide volcanoes into two classes: The quiet, characterized by a flow of lava, and the explosive, characterized by the blowing out of fragments. Prof. Heilprin states positively that no lava has flowed from the crater of Mont Pelée. One of the main characteristics of the explosive volcano is what is called the "cinder-cone." This is formed of material which is cast out and which drops back around the orifice from which it was thrown, forming a cone. Prof. Heilprin, however, states that no such cone was found in this volcano. What was taken to be a cinder-cone proved to be but a pile of ejected rocks with no central vent. Of course, in the present condition of Mont Pelée it is impossible to state absolutely that there is no cinder-cone, for it was possible to see down only about 200 feet, and it is believed that the crater is much deeper than this. In shape, the new crater appears like a great gash in the mountain, running north and south and expanding into a bowl. The fissure runs transversely to the old crater, and appears to have nearly rifted the mountain. In the first reports of the eruption statements were made that the mountain had been reduced to one-third its original height. This is now shown to be utterly untrue, for from a number of observations taken with an aneroid barometer it was found that the height of the mountain had remained unaltered and that no important topographical changes had taken place. The exaggerated reports may have had their origin in the fact that a dense cloud of steam normally covers the top of the mountain, which might lead to the supposition that the mountain was much reduced in height. From the investigations made, Prof. Heilprin considers violent eruptions improbable. Mont Pelée has freed itself of interior pressure, and while small disturbances may continue to occur, they will probably decrease in frequency and power. However, no one can prophesy with certainty on subjects of this sort. Volcanic action is very little understood; new and unexpected phenomena are continually occurring. The explosion of flaming gases is unprecedented, so far as known, and was probably the main cause of the terrible loss of life. The electrical phenomena were also new, though they probably did not play an important part in the destruction of the city. Specimens collected by Prof. Heilprin show that the lightning bolts were small and very intense, penetrating the walls of the houses. No other volcano was ever so rapid in action, and never before has such a loss of life resulted directly from a volcanic eruption.

THE COMMERCIAL PROSPECTS OF AFRICA.

The declaration of peace in South Africa, which is to be followed by the reopening of the greatest gold-producing mines of the world and presumably by a general revival of business in that greatest consuming section of Africa, lends especial interest to a monograph on Commercial Africa in 1901, just issued by the Treasury Bureau of Statistics. The commerce of Africa, according to this authority, amounts to over $700,000,000, of which $429,000,000 represented the value of the imports. About three-fourths of the imports of Africa are through the ports of the extreme north and south of the continent, those at the north being for the consumption of the more densely populated regions bordering on the Mediterranean and considerable quantities going to the interior by caravans —a large part across the Sahara to the densely populated regions of the Soudan. At the south, a large share of the imports is, under normal conditions, for use at the gold and diamond mines, which lie a few hundred miles north of the Cape, and are reached by railway lines from Cape Colony and Natal at the south and from ports of Portuguese East Africa on the southeast.

A very large proportion of the trade of Africa is with England. There are numerous reasons for this, the most important, however, being that her colonies —Cape Colony and Natal—on the south are the avenues through which pass most of the goods for that section, and that a very large share of the growing trade is also carried by British vessels; while the bulk of the mining, as well as the stock raising and general development of that section, is in the hands of British colonists or capitalists. In the north, a large share of the trade of Egypt is given to Great Britain, whose influence in the management of Egyptian affairs is well recognized; while in Algeria, which has a large trade, a very large proportion is with France, the governing country.

The total recorded imports into Africa, aggregating in the latest available year $429,461,000, were distributed as follows: Into British territory, $157,575,000; French territory, $92,004,000; Turkish territory, $77,787,000; Portuguese territory, $20,795,000; German territory, $8,336,000; and in the Congo Free State, $4,722,000. Of this importation of $429,461,000, about 5 per cent was furnished by the United States, the total for 1901 being $25,542,618. Our total exports to Africa have grown from $6,377,842 in 1895 to $18,594,424 in 1899, and $25,542,618 in 1901. This rapid increase is largely due to the fact that orders sent to the United States for mining machinery and other supplies so much in demand in South Africa are promptly filled with goods of the latest pattern and most acceptable character.

Africa occupies fourth place in the list of the grand divisions of the world in its consuming power in relation to international commerce, the imports of the grand divisions according to the latest available figures being as follows: Europe, $8,300,000,000; North America, $1,300,000,000; Asia, $900,000,000; Africa, $430,000,000; South America, $375,000,000; and Oceanica,

$325,000,000. Of this total of $11,630,000,000, the United States supplies 5 per cent in the case of Africa, 10 per cent of the imports of South America, 10 per cent of those of Asia and Oceanica, 14 per cent of the imports of Europe and 40 per cent of the imports of North America, exclusive of the United States.

Railroad development in Africa has been rapid in the past few years, and seems but the beginning of a great system which must contribute to the rapid development, civilization and enlightenment of the Dark Continent. Already railroads run northwardly from Cape Colony about 1,500 miles and southwardly from Cairo about 1,200 miles, thus completing 2,700 miles of the proposed "Cape to Cairo" railroad, while the intermediate distance is about 3,000 miles. Including all of the railroads now constructed or under actual construction, the total length of African railways is nearly 12,500 miles, or half the distance around the earth.

That the gold and diamond mines of South Africa have been and still are wonderfully profitable is beyond question. The Kimberley diamond mines, about 600 miles from Cape Town, now supply 98 per cent of the diamonds of commerce, although their existence was unknown prior to 1867, and the mines have thus been in operation but about 30 years. It is estimated that $350,000,000 worth of rough diamonds, worth double that sum after cutting, have been produced from the Kimberley mines since their opening in 1868-69, and this enormous production would have been greatly increased but for the fact that the owners of the various mines there formed an agreement to limit the output so as not to materially exceed the world's annual consumption.

Equally wonderful and promising are the great Witwatersrand gold fields of South Africa, better known as the Johannesburg mines. Gold was discovered there in 1883, and in 1884 the value of the gold product was about $50,000. It increased with startling rapidity, the product of 1888 being about $5,000,000; that of 1890, $10,000,000; 1892, over $20,000,000; 1895, over $40,000,000; and 1897 and 1898, about $55,000,000. Work in these mines has been practically suspended during the war in progress in that section within the past two years. The gold production of the Rand since 1884 has been over $300,000,000, and careful surveys of the field by experts show beyond question that the gold in sight probably amounts to $3,500,000,000, while the large number of mines in adjacent territory, particularly those of Rhodesia, whose output was valued at over $4,500,000 last year, gives promise of additional supplies, so that it seems probable that South Africa will for many years continue to be, as it is now, the largest gold-producing section of the world.

CHEMICAL INDEXING BY THE PATENT OFFICE.

BY MARCUS BENJAMIN, PH.D.

During the meeting of the National Academy held this year in Washington, several of the visiting chemists examined with much interest the system of indexing chemical literature now in use in the classification division of the United States Patent Office, and their appreciation of its value was so great that a brief description of that work seems desirable.

The system is a simple one, and in a general way follows the plan used originally by Richter in his Lexicon of Carbon Compounds, and later in the well-known indexes of the Berichte of the German Chemical Society, although it is proper to say that it was worked out by Mr. E. C. Hill, of the Patent Office, without any knowledge of either of these works and is less complex.

It is pertinent in this connection to add that Mr. Hill has already in a somewhat lengthy paper* explained his system and described how it is an improvement over the method used by Richter and by Jacobsen and Stelzner in the Berichte. In this paper Mr. Hill advocated the idea of a central bureau in Washington, to have for its purpose the supervision of the index of chemical literature, and he contends that "some such plan properly matured and carried out to a successful completion would be work worthy of the greatest scientific institution of the national capital, founded expressly for the dissemination of useful knowledge, and would be directly in line with their publication in past years of the indexes to the literature of specific chemical bodies, which has so much redounded to its credit." It is obvious that he has referred in this quotation to the Smithsonian Institution.

The usual library cards are employed, and there are two series of these. The most important one is that giving the formula, and the arrangement of these is governed by the following general rules in the order here given:

1. The number of carbon atoms in carbon compounds.

2. The number of hydrogen atoms in carbon compounds.

3. The alphabetical arrangement of the symbols of the remaining elements (including hydrogen in other than carbon compounds).

In order to make the treatment perfectly clear, let me illustrate the system by taking the compound diphenoldiacetonehydrazone, of which the constitutional formula is $C_{12}H_6(OH)_2[N_2HC(CH_3)_2]_2$. Arranging the atoms according to the foregoing rules we will have as the empirical formula $C_{18}H_{22}N_4O_2$, which is then written at the top of the card with the reference below. In this case the reference happens to be Part 6 of the third volume of Roscoe and Schorlemmer's Treatise on Chemistry, where that compound is described as crystallizing "in rhombic plates, melting at 200 deg., which are insoluble in alcohol and ether, sparingly soluble in ammonia, but readily in caustic."

The value of this index is clearly apparent. An inventor describes a compound of which the empirical formula is as above possessing properties as described, and its identity is established at once. A long and tedious search among the many volumes of chemical literature is unnecessary, for in five minutes the card tells the exact facts in the case. These formula cards begin with compounds containing one atom of carbon and extend through many thousands until an end is reached with the formula $C_{867}H_{1363}CuN_{223}O_{258}S_4$, representing one of the blood pigments, known as homocyanin.

The second series of cards comprises those on which the name of the compound is given with a cross reference to the formula; thus, for instance, there is a name card for "acide acetique" with reference to the formula $C_2H_4O_2$, i. e., acetic acid. The chief value of these cards is to catch special or uncommon names that might otherwise escape the attention of the examiner.

The books already indexed are nearly fifty in number, and include such important works as Roscoe and Schorlemmer's valuable Treatise on Chemistry, the various text books by Ira Remsen, the SCIENTIFIC AMERICAN Cyclopædia of Receipts, Notes and Queries, the several indexes to chemical literature published by the Smithsonian Institution, and many special works on technology, as well as the letters patent issued from Class No. 23, on chemical, and Sub-Class No. 24, on carbon compounds of the United States Patent Office. Many of these books have been indexed page by page, while cards from the others have been made up from the indexes only.

Work is now being done on the collective indexes of the Chemical Society of London, and on the collective and annual indexes of the Society of Chemical Industry. Already more than 200,000 cards have been made, and it is easy to see that the references will reach into millions before the work is brought up to date.

It is a special pleasure to call the attention of the readers of the SCIENTIFIC AMERICAN to this valuable work, which was undertaken by Mr. Edwin C. Hill some three years ago, and to whose active interest and belief in its utility the world at large owes a debt of gratitude. Mr. Hill has been fortunate in receiving the hearty co-operation of his immediate superior, Mr. Frank C. Skinner, chief of the classification division, and Commissioner of Patents Allen, who is constantly on the alert to introduce improved methods in the Patent Office, has given this index his cordial support.

* On a System of Indexing Chemical Literature; adopted by the classification division of the United States Patent Office. Journal of the American Chemical Society, xxii, 1900, pp. 478-494.

SINKING A SHAFT BY FREEZING.

An interesting experiment with the freezing system of shaft sinking is being carried out at the Washington Colliery in the North of England. This process, the patent of Messrs. Gebhardt and Koenig of Nordhausen, has been found indispensable for sinking a shaft where the peculiar conditions of the soil, such as sand or sliding clay, prevent the shaft being sunk in the ordinary way. At this Washington Colliery, when operations were commenced for sinking the shaft, it was discovered after the surface earth had been removed, that the next geological stratum consisted of wet and "quick" sand. Had attempts been made to bore the shaft through such a stratum as this by conventional means, the water would have penetrated into the hole, and the sides would have fallen in, endangering the lives of the artisans below. Also, if pumping had been tried, the pumps would have brought away sand as well as water, and thus have caused a still greater collapse. The bed of sand is 80 feet in thickness, and is followed by 30 feet of bowlder clay.

The "freezing" process consists in freezing the sand around the shaft ring until it becomes perfectly solid. When the site of the shaft was decided upon, a ring pierced with twenty-two holes was bored in the ground, the diameter of the ring being 22½ feet. Into each of these holes an iron pipe was placed, having within it a copper tube, with a perforated bottom. A freezing mixture comprising brine of chloride of magnesium 26 per cent, cooled by means of the liquefaction of ammonia, was run into the copper tubes, passed through the perforated bottoms into the iron tubes—which were closed at the ends—and passed back to the tanks, so that a constant circulation was kept up. The temperature of the brine was 20 degrees below zero, and this had the effect of freezing the ground around the pipes so solid that the result was a circular wall of frozen sand as hard as rock. The excavators then removed the soft sand inclosed by the frozen wall, chipped the wall in to the form of a perfect circle, put up a temporary "tubbing," and so proceeded downward. The ground took seven weeks to freeze.

The wall was approximately 10 feet thick at the end of seven weeks' freezing, and 4 feet of this is being chipped away, leaving 6 feet remaining. As the hole deepens, the pipes are carried down with it, and the wall, once frozen, is to be maintained in this condition until the stone head is reached. Then it will be replaced by a brick wall, or rather by two brick walls, with a brine mixture between them. By the employment of this method, pumping is dispensed with. No water can get through the frozen area, and it is as safe from collapse as if it were the solid rock. The opening of the shaft is completely covered up, and trap-doors are provided for the passage of the excavated earth and workmen. The interior of the shaft at the working face is illumined with electric light, and the cold is intense.

PRELIMINARY WORK ON THE $3,000,000 GOVERNMENT CONTRACT IN THE PHILIPPINES.

BY A. W. CLAPP.

The government contract awarded a short time ago to the Puget Sound Bridge and Dredging Company for the improvement of the harbor of Manila and the building of a complete coaling station at Cavite is one of the largest contracts of its kind ever given to a single concern. Three contracts in number, aggregating about $3,000,000, were awarded. That of the improvement of the harbor comprises two contracts amounting to $2,500,000, while the third and smaller one is for $600,000.

Harbor improvements comprise the dredging of that portion of Manila Harbor at the mouth of Pasig River, 4,500 feet wide by 8,011 feet in length; in other words, the removal of over 5,000,000 cubic yards of material; the building of 8,000 feet of stone breakwater, the top of which will be finished with a capping of concrete; the building of 4,500 feet of rough stone with no finish along the front of the walled city, following the contour of the famous Malacan drive.

The smaller contract is for the construction of a coaling station located at Ianglei Point in the vicinity of the arsenal at Cavite. The principal work here is the building of mammoth steel coal bunkers, for which 4,500 tons of structural steel, 3,500 piles, 500,000 feet of lumber, 50,000 barrels of cement and a large amount of rock from the quarries will be used.

The preliminaries for this work, before a yard of rock can be laid or a foot of earth dredged, are fair-sized contracts in themselves. First the company has established headquarters at Manila, near which are the company's ship yards. Here will be built a fleet of a dozen scows and a steel launch which will be used to tow the stone from the quarries across the bay. These barges will be 125 feet in length. The dredge will be shipped from the United States and put together at the yard. It will be a suction dredge built of steel.

Across the bay, 30 miles distant, are the quarries, where a large plant has been constructed. An aerial tramway, with a 1,000-foot span, extends across a small stream, by which barges are loaded. The tram-car can transfer 1,000 tons of rock every 24 hours. In all, 240,000 tons of rock are to be taken from this quarry and towed a distance of 30 miles across the bay to Manila.

A large wharf has been built at the quarry, at which vessels can land. Besides this, roads have been constructed and a water supply established. These improvements, with drilling, hoisting and engines, will cost in the neighborhood of $400,000.

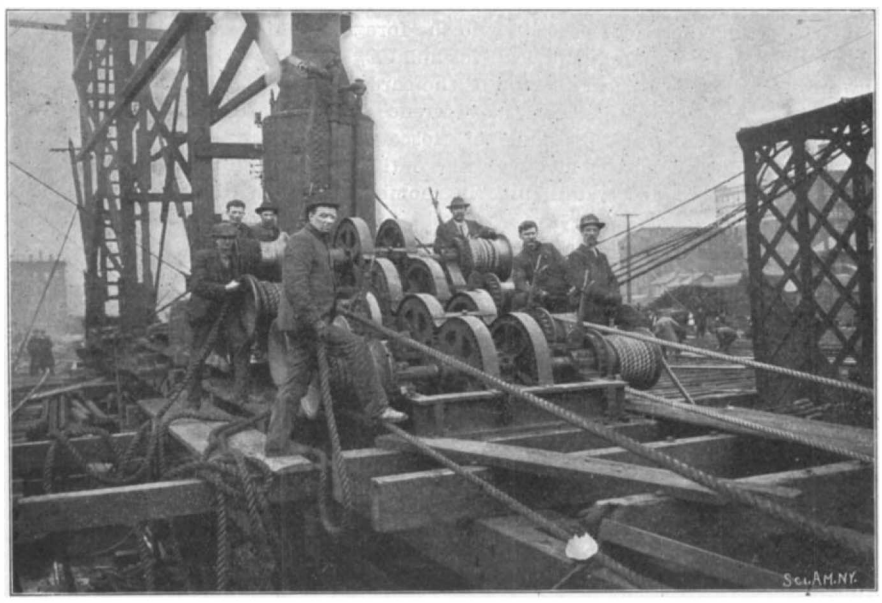
The plant for work on the coaling station will cost about $75,000. Here will be established a ship yard, where more scows will be built as well as a small tug.

In the construction of the wharves, barges and ship yards and work of all kinds, a million and a half feet of lumber have been used, besides many thousands of piles. All lumber and piling is of Douglas fir, and was shipped from Seattle. All hardware and groceries for the subsistence of the two camps have also been shipped from that point. The company will also have all coal used on the entire contract shipped from the United States.

When all preliminaries are completed work will be pushed as fast as possible. With the building of the breakwater in Manila Bay, which was commenced by the Spanish government and left half finished, the harbor will be one of the finest in the Orient. As the Pasig River is crowded when heavy storms are raging, as well as the bay, the breakwater constructed will give a refuge to all ocean-going craft of the world.

MOVING A LARGE RAILWAY BRIDGE.

The Pittsburg, Fort Wayne & Chicago Railroad crosses the Allegheny River at Pittsburg on a bridge of the old-style lattice-work construction. The company has decided to replace it with a structure of the "double-deck" pattern, which will be used for a railway and highway. It is to be erected upon the original piers of masonry. To prevent interruption of train service, it was decided to construct wooden piers and move the present bridge upon these. Although the mass of metal weighed over 2,000 tons, the actual time of removal occupied less than half a day. The Pittsburg section had to be changed 23 feet, and the Allegheny section 48 feet. The bridge was moved in a manner somewhat similar to that used in moving a house, a system of rollers being used. There was a set of these rollers at each end and at each pier. Beneath the rollers were placed a number of pieces of rail, and between the bottom of the bridge and the rollers, rail was also used. Three hoisting engines and rope and pulley-blocks pulled the bridge to its new position, and had not extraordinary precaution been used, it could have been moved in much less time. The bridge was moved about five feet at a time, and then given a thorough examination before being moved again. This operation was repeated until the bridge reached its new bed.



One of the Powerful Hoisting Engines Used in Pulling the Bridge to Its New Position.

Structural ironworkers to the number of 100, and 150 carpenters, were used on the work, and after the removal had been accomplished, about 125 men changed the network of the tracks and switches at each end of the bridge by shifting them with crowbars. This part of the work took more time than the moving of the bridge. The plans were carried out under the supervision of Engineers G. H. Mitchell, of the American Bridge Company, and Thomas Rodd, of the Pennsylvania Company.

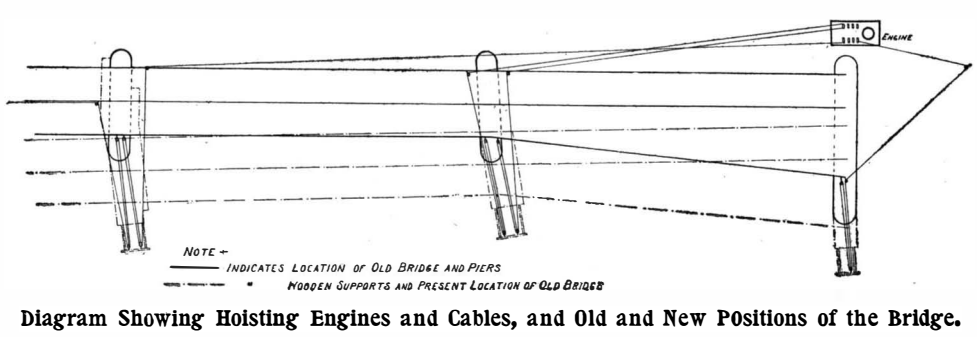


Diagram Showing Hoisting Engines and Cables, and Old and New Positions of the Bridge.

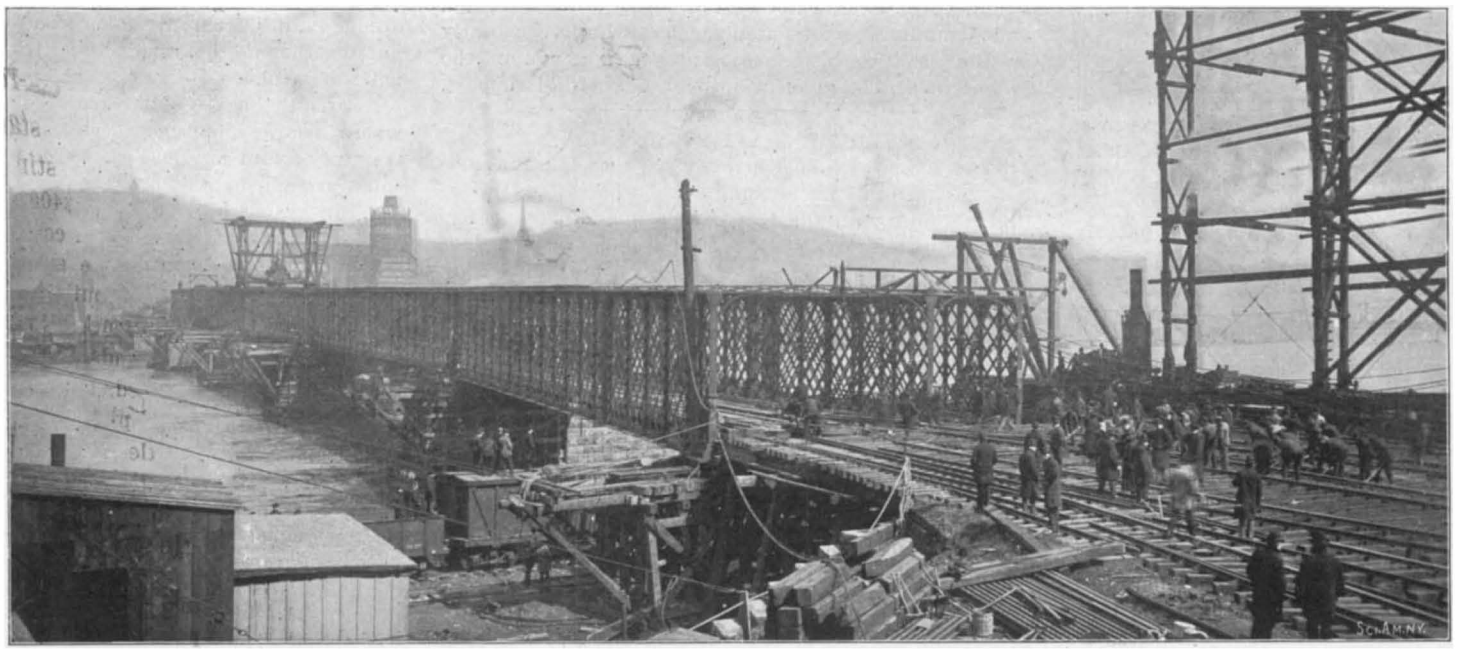
Mortality From the Bite of Poisonous Snakes.

BY CHARLES H. COE.

The mortality throughout the world from the bite of poisonous snakes is unknown. From partial statistics, however, covering many years, some idea may be had of the number who met death in this terrible manner. India reports a death rate from this cause that is appalling to contemplate. There are many species of venomous serpents within her borders, but only five are especially destructive to human life. These are as follows:

The cobra de capello (*Naja tripudians*) or hooded snake; the hamadryad (*Ophiophagus elaps*); the krait (*Bungarus caeruleus*); the kuppur (*Echis corinata*); and the chain viper (*Daboia russellii*). The cobra is common throughout the country; its cast-off skin has even been found at an altitude of 8,000 feet in the Himalayan Mountains. The others are more or less common, according to locality. In a small division of this vast empire, containing only 13,855 square miles (only a little more extensive than the State of Maryland), and a population of 7,000,000 souls, more than 1,000 persons, according to the Report of the Commissioner of Burdwan, annually die from snake poisoning. When the extent of the country (1,560,159 square miles) and its immense population (nearly 300,000,000) is taken into consideration, together with the statement just made, it will not surprise the reader to learn that an average of 20,000 persons annually succumb to venomous snake bites in India alone. The actual number of deaths during the decade 1880-1890, according to the latest available statistics, varied from 18,670 to 22,480 per year. For many years past the government of India has offered rewards, or "head money," for the destruction of venomous serpents. Notwithstanding the payment of large sums for this purpose, however, neither the supply of snakes nor fatalities from their bite seem to have decreased. During the above-mentioned decade the number of snakes (poisonous) killed varied from 212,776 to 578,415 annually.

France has had a similar experience in this latter direction. In three departments, or counties, a premium of 25 centimes was offered for the destruction of vipers, which reptiles were responsible for many deaths. According to official reports, the number of snakes killed in one year (1864) was 1,934, while in 1890, twenty-six years later, 67,620 vipers were destroyed, or a total of 294,577 during the whole period. In both cases, instead of diminishing in numbers, the snakes seem to have actually increased under the bounty system. It has been stated that in some localities the people have resorted to breeding certain poisonous snakes for the sake of the rewards offered. The truth of this oft-repeated assertion is very doubtful, however, especially in regard to the former country, where the reptiles are so numerous that their capture is effected with little difficulty.



MOVING THE PITTSBURG, FORT WAYNE & CHICAGO RAILROAD BRIDGE AT PITTSBURG.

In North and South Africa there are several highly venomous species, the most dreaded being the African cobra (*Naja haja*), the spitting snake (*Sepedon haemachates*), and the sheep stinger (*Causus rhomblatus*). Australia has about twenty poisonous species, five of which are extremely deadly. Among the latter are the brown-banded snake (*Hoplocephalus curtus*), the brown snake (*Diemenia superciliosa*), and the black snake (*Pseudechis porphyriacus*). Tropical America, including several islands in the West Indies, notably Martinique and St. Lucia, contains a number of pit vipers, the largest and most formidable known. The terrible fer de lance (*Trigonocephalus lanceolatus*) is confined to the islands, where a bounty has had little or no effect in diminishing its numbers. It is regarded with the utmost fear by the natives. The mortality from snake poisoning in Africa, Australia, and tropical America is not specially recorded. While it is known to be small in comparison to that of India it is still considerable, according to the reports of travelers and notices in the public prints. The fer de lance alone, in the West Indies, is the cause of many deaths annually.

In our own country we have four genera of venomous serpents, as follows: The rattlesnake proper (*Crotalus*), the copperhead, and the moccasin (*Agkistrodon*), the coral snake (*Elaps*), and the ground rattlesnake (*Sistrurus*). Of the former there are several species, and at least two of the coral snake. The huge diamond rattlesnake (*C. adamanteus*) and the copperhead (*A. contortrix*) are the most deadly. The former species of rattlesnake is undoubtedly the cause of more deaths from snake poisoning than any other in the United States. This is due to its large size (not infrequently seven feet in length and three inches in diameter), and to the great length of its fangs and the copious amount of venom injected into its wounds. There are no means of ascertaining the annual mortality from snake poisoning in the United States. It is not large, and fatalities are now mainly confined to the South and the West. In these sections the country newspapers contain occasional reports of deaths from this source. Perhaps the total number would not exceed fifty. Not a year passes without one or more deaths from rattlesnake poisoning in the State of Florida. During six years, without the facilities of carrying on a systematic search, the writer came across and preserved eight newspaper notices of well-authenticated deaths in the State from this cause. Three of these occurred in 1897. Perhaps 30,000 would be a fair estimate of the world's annual death-rate from the bite of venomous snakes, notwithstanding the long and practically fruitless efforts of science to discover an antidote.

Bologna has been having a sensation in the rumor that its great leaning tower, the pride of the city, is weakening, and may fall, says the New York Tribune. This has caused so large an influx of visitors that it is said that the hotelkeepers may not be wholly guiltless in regard to the rumor. The city has two of these square towers, the Asinelli, which is 315 feet high, and was erected in 1109, and its rival, the Garisenda, which was built one year later, and was originally much higher, and is rendered peculiar by its decided inclination to one side. It is now only 153 feet high, the width of one side is 23 feet, the walls at the base are 6 feet 6 inches thick, while higher up they are 4 feet 9 inches. Its origin is somewhat obscure, but it was certainly intended to outdo the Asinelli, and both were for retreat in troublous times. Some say the original intention was to make it lean, but others contend that either the ground has settled or there was a defect in the engineering. This unique relic was so little thought of by one of its late possessors that it was sold for 220 lire, something less than $44.

The American Museum of Natural History recently acquired a group of five caribou, which hail from the Barren Islands of Alaska, and are of an entirely new species. These rare animals were brought home by the Andrew J. Stone expedition.

THE ELECTRIC ROAD OF BERTHOUD-THOUNE, SWITZERLAND.

During the course of the year 1899, a road was opened in Switzerland, between Berthoud and Thoune, which, like the mountain lines of Gournegrath and Jungfrau, uses as a motive power the three-phase low-tension electric current. The road, which was built by Brown, Boveri & Co., is essentially one of standard dimensions, and operated practically under the same conditions as a steam line. For that reason the results which have been obtained during the two years of service should prove of no little interest.

The total length of the line, which is a single-track road, is 40 kilometers (24.8 miles). Starting at Berthoud (Burgdorf), a station on the Berne-Olten line, the road follows the Emmenthal Railway for a distance of 7 kilometers (4.3 miles) to the station of Hasle-Ruegsau. At Konolfingen it crosses the Berne-Lucerne line, and finally connects at Thoune with the road running from Berne to Interlaken.

The maximum grades have been fixed at 25 millimeters per meter (0.98 inch per 3.26 feet). The minimum radius of the curves is 250 meters (815 feet).

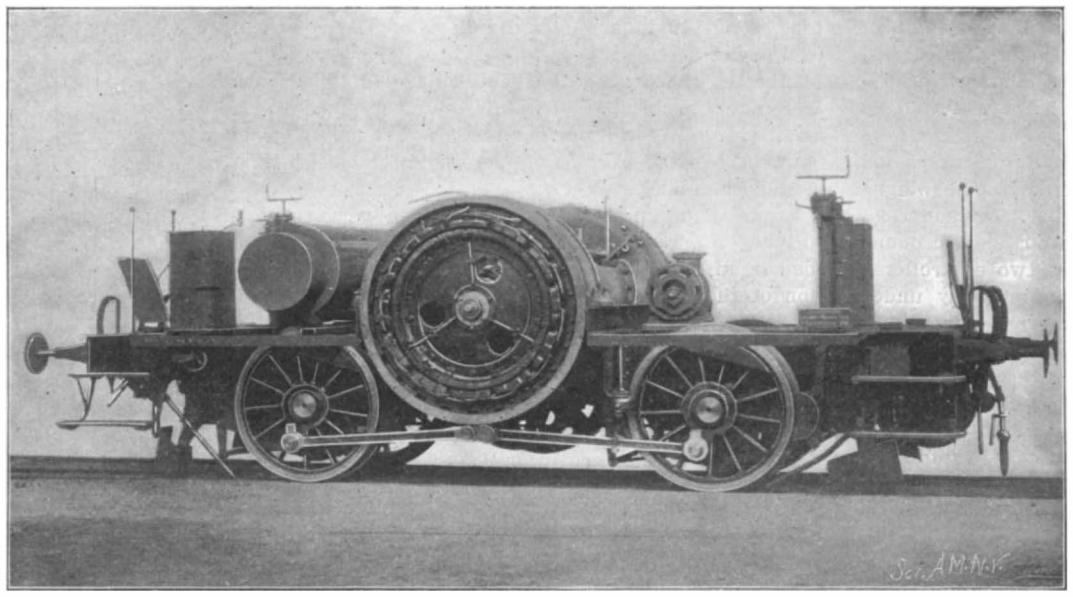
The current is generated at Spiez by a hydro-electric plant connected with sub-stations, distributed along the line at intervals of 3 kilometers (1.8 miles). Three-phase current is fed to these stations under a tension of 16,000 volts, and is stepped down to 750 volts to the line conductors. The passenger rolling stock is composed of six auto-motor coaches each weighing 32 tons empty, and of ten ordinary passenger cars. Freight is transported by means of sixty cars of the ordinary type and two electric locomotives.

The Spiez central station, which is situated on the shores of Lake Thoune, derives its water power from the falls of the Kander flowing into the lake. Part of the Kander River is diverted by means of a canal running along the falls for a distance of 680 meters (2,217 feet). The canal communicates with a tunnel 860 meters long (2,721 feet), at the entrance of which is a gate. The total head of water is 63 meters (206 feet), from which it follows that about 5,500 horse power is generated. Horizontal, Escher-Wyss turbines to the number of six, each of about 900 horse power, are directly coupled to three-phase alternators of the Brown-Boveri type. The speed of these alternators is 300 revolutions per minute. The tension of the current which they generate is 4,000 volts, which is afterward raised to 16,000 volts by means of static transformers. The high-tension conductors extending from the central station to Thoune are secured to metallic supports embedded in blocks of concrete spaced 50 meters (163 feet) apart. These high-tension conductors are composed of three copper wires having a constant diameter of 5 millimeters (0.2 of an inch) for their entire length. The same supports likewise serve as a fastening means for various feeders for power and lighting purposes.

Throughout the entire length of the line the feeders for the cars are supported simply by pine posts injected with zinc chloride. The posts are about 8 meters (25 feet) high and are spaced 45 meters (146.7 feet) apart.

The height of the posts for the high-tension conductors has been so chosen that the lowermost wire is never less than 6 meters (19.5 feet) above the ground. The posts are placed 45 meters apart. Wherever a highway or a railway is crossed, this distance has been reduced as far as possible in order to avoid the use of guard nets. Wherever a railway is crossed, netting is used.

The wires are secured to the necks of the insulators so that they face the post. Hence, in case of a rupture, the wires will fall upon the framework of the posts. Posts which are situated at curves are provided with frames of iron, which serve to prevent the wires from falling to the ground. The insulators are of the double-bell type. At intervals of five posts horn lightning arresters are employed.



LOCOMOTIVE WITH BODY AND MOTOR-CASINGS REMOVED.

It has been said that the wire of which the high-tension line is composed has a constant diameter of 5 millimeters. The lines which supply the transformers are composed of wires 4 millimeters in diameter. The longest of these lines measures not less than 750 meters (2,450 feet).

The transformer sub-stations, which number fourteen, have been located, so far as possible, in the vicinity of stations, in order that they can be more readily inspected from time to time. The average distance between such stations is 3 kilometers (1.8 miles). The first and last sub-station are each situated about 500 meters (1,630 feet) from the terminals of the line.

The transformers of the sub-stations have been proportioned on the assumption that there would never be more than one train on the same section of road. The calculations made, which allowed for grades, gave different results for different sub-stations. It was, therefore, decided to adopt one type of transformer for the purpose of avoiding too great a complication.

Each sub-station contains a 450-kilowatt transformer, which is of sufficient power to drive a double train.

One of the terminals of the secondary winding of the transformer is directly connected with the rails of the line by means of a wire 8 millimeters (0.3 inch) in diameter. The two other terminals are directly connected with a small switchboard inclosed in a sheet metal casing, secured to two wooden posts planted on the other side of the road. By means of this little switchboard, which is provided with the usual circuit-breaking and measuring devices, the wires conveying the current to the motors of the cars can be placed in connection with the secondary winding of the transformer. Adjacent to the station containing the transformer which furnishes power to the line are two posts, which support the transforming device, which is connected with the lighting circuits and which is directly supplied by a high-tension feeder. Some of the lighting transformers are, however, fed by the line. The two posts upon which the lighting transformers are carried are provided with a high-tension switch, by means of which circuits leading to the transformer stations can be broken.

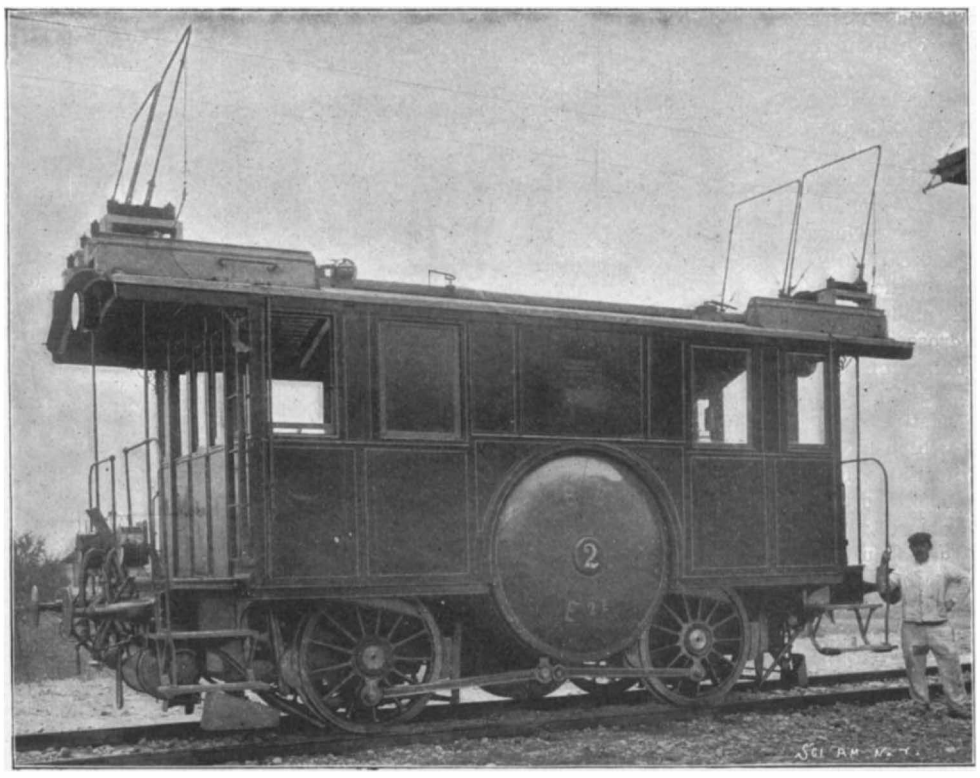
The high-tension line is protected by horn lightning arresters.

The trolley wire by which the cars are driven is composed of two copper wires 8 millimeters in diameter. These trolley wires are suspended from insulators which have resisted a tension of 6,000 volts, and also from ball insulators. The transverse wires, by which the different parts of the line are supported, are composed of steel wire 6 millimeters (0.23 inch) in diameter. The transverse wires are suspended from the post by means of hangers, of such construction as to permit a play of 30 centimeters (15.7 inches).

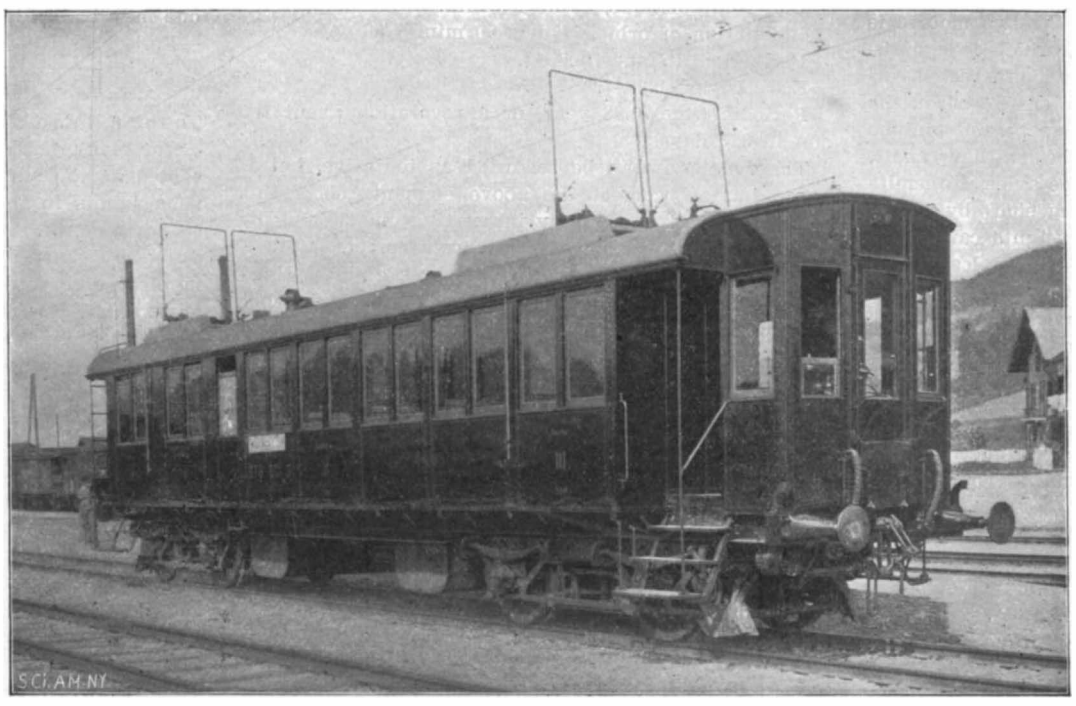
As we have already seen, the trolley wire is divided into five sections, separated from each other by sectional insulation, whereby it is possible to cut out one section whenever it is necessary to make repairs.

As a general rule, the transverse wires are spaced about 35 meters (104.8 feet) apart. This distance is reduced at highway crossings, in order to attain great safety. On curves the distance has also been decreased, in order to prevent the trolley loop from leaving the wire.

For the return of the current a method of connection has been devised by the engineers of the Brown-Boveri Company, which consists in making use of fish-plates to conduct the current to the rails. As a matter of fact, this system of return has been long used in



A LOCOMOTIVE OF THE BERTHOUD-THOUNE ELECTRIC ROAD.



AN AUTOMOTOR COACH OF THE BERTHOUD-THOUNE ELECTRIC ROAD.

England and in the United States in a somewhat different form.

The rolling stock of the road consists of motor cars, electric locomotives, ordinary passenger coaches and freight cars. The motor cars have a seating capacity of 66, and are divided into first and second-class compartments. Each motor car has a hauling capacity of 20 tons at a speed of 36 kilometers (22.4 miles) per hour, on a 25-millimeter grade. The weight of each motor car is 32 tons. The body, which has a length of 16.3 meters (53½ feet) between the buffers, is carried on two bogie trucks separated by a distance of 9½ meters (30.1 feet). Each axle carries a motor of 60 horse power, with a speed of 600 revolutions per minute. The total weight of electrical equipment of the motor car is about 10 tons. Each motor alone weighs 1,500 kilogrammes (33,000 pounds). The electrical equipment of these cars, besides four asynchronous motors of 16 horse power, comprises two controllers; four variable resistances disposed transversely under the bodies between the bogie trucks; one controlling device for these resistances; four trolley loops; two sheet-metal boxes inclosing each four lead fuses, conveying current to the motors; one 18-kilowatt transformer to step down the current from 750 to 100 volts, for heating and lighting the car; one box containing fuses for the transformer; one compressor driven by a four horse power motor supplied with current at a hundred volts; one automatic circuit breaker for the motor of the compressor; six electric lamps for regular outside lighting; ten lamps for interior illumination; fourteen electric radiators for heating; six heat regulators; and one small switchboard carrying the switches controlling the radiators and the lamps, as well as the lead fuses of the motor of the compressor.

The three-phase motors employed have eight poles, with a fixed field magnet and movable armature. The winding of the field magnet comprises fifty-one turns for each phase. The resistance of the winding of a phase is 0.71 ohms. The winding of the armature comprises eight turns per phase, and the resistance of the winding for each phase is 0.0153 ohms. When the armature turns with a speed equal to that of the generating dynamo, the number of revolutions is 60 per minute. The four field magnets of a car are mounted in parallel in the circuit conveying the current. The four armatures are connected with four independent rheostats located beneath the car and regulated simultaneously by the controllers. These rheostats are used at the moment of starting. In order to cut out a motor the two corresponding circuit breakers are operated.

The trolley loops are of rather novel form. They consist of two frames placed side by side and carefully insulated from each other. That portion of the loop which is subjected to sliding friction is made of a highly polished brass tube triangular in cross section. By a single rotation of 120 degrees the surface of contact can be changed.

Each motor car is equipped with a Westinghouse air-brake as well as the usual shoe-brakes, which latter serve not only to check the speed on down grades, but to bring the car to a stop. In order to check the car on down grades, the motors themselves are used; for when the number of revolutions exceeds that required for perfect synchronism a braking action is obtained.

The locomotives employed for the haulage of freight trains are carried on two axles. Their weight is abouf 30 tons each.

The locomotives are provided with sills similar to those of steam engines. By reason of the comparatively large amount of space taken up by the two motors, which are each of 150 horse power, it was found impossible to mount them in the usual way. They were, therefore, disposed outside of the two sills. The method employed to transmit to the axle the movement of the common shaft of the two motors is original. Beneath the motor shaft, which is equidistant from both axles, is an auxiliary shaft, which carries two gears meshing with two pinions keyed on the motor shaft. These two groups of gears and pinions constitute a variable speed gear. The auxiliary shaft, which turns at the same speed as the axles, transmits to them the movement of the driving shaft by means of four connecting rods. Counter weights carried on the auxiliary shaft balance the rods and lessen the perturbations due to the inertia of the parts.

This arrangement of the motors may, at first sight, seem open to criticism. It must, however, not be forgotten that the locomotive is intended to be used for the haulage of heavy freight trains at fairly high rates of speed.

The speed of the motors is 300 revolutions per minute. Two changes of speed are obtained by cutting out one of the trains of gears.

With the motors developing a speed of 300 revolutions per minute, the normal speed attained is 33.6 kilometers per hour (21.6 miles) with a high-speed gear. By throwing in the other train of gears, the speed is reduced one-half. In this latter case double the load can be hauled. The throwing in of the gears cannot be accomplished while the train is in motion.

Each locomotive is equipped with two controllers similar to those to be found on the auto-motor passenger cars. Starting is effected by the interposition of resistances, which are cut out when the speed has risen to a certain point. The electrical equipment of these locomotives is almost exactly similar to that of the auto-motor passenger coaches.

The length of a locomotive from buffer to buffer is 7.8 meters (25.58 feet); the diameter of the wheels is 1.23 meters (4 feet); the total weight is about 30 tons, about 10 tons of which fall upon the electrical equipment.

Like the coaches, the locomotives are equipped with Westinghouse brakes. The air is compressed by a small pump driven by a four horse power motor. The starting resistances of the motors are inclosed in a cylindrical casing.

From all accounts the road has been very successfully operated at a comparatively low expense. The road is still another instance of the successful adaptation of the polyphase current to electrical traction.

THE BROOKS COMET OF 1902.

BY DR. WILLIAM R. BROOKS, F.R.A.S.

Announcement of the discovery of this comet on April 14 was duly made in the Scientific American. The writer was engaged in sweeping the eastern morning heavens with the ten-inch equatorial telescope of this observatory, when the comet was discovered near the northwest corner of the great Square of Pegasus.

It is a curious fact that this comet was found in the same telescopic field in which my comet of February 23, 1883, was discovered, that, however, being in the evening sky. This is, of course, simply a coincidence, and does not indicate that the two comets are identical, or indeed, have any relation to each other.

The appearance of this latest comet is well shown in the accompanying picture—a highly magnified telescopic view. The body of the comet was slender, tapering gradually to the coma, which had a minute stellar nucleus. The tail was narrow and slightly branching. The comet was fairly bright in telescopes of moderate power and an interesting object.

THE BROOKS COMET OF 1902.
Discovered by Dr. Brooks April 14.

Its path was diagonally across the Square of Pegasus, and at the time of discovery was moving toward the sun at the rate of three degrees daily.

The following elements of the comet's orbit have been furnished by Prof. Leuschner:

Time of passing perihelion, May 28.
Perihelion minus node, 274 deg. 30 min.
Longitude of node, 35 deg. 3 min.
Inclination of orbit, 71 deg. 50 min.
Perihelion distance, 0.5542.
Eccentricity, 0.3947.
Periodic time, 0.88 year, or a revolution about the sun in 320 days.

These data are to be regarded as tentative, but if approximately correct the above elements show this comet to be an exceedingly interesting one, having by far the shortest period of any known comet.

Encke's comet has a period of three and one-third years—the shortest heretofore discovered—and other short-period comets have periods ranging from five and a half to thirteen years; while this latest cometary addition to our solar system, should the above elements prove fairly accurate, performs its revolution in less than a single year.

The comet is at this writing lost to view in the sun's overpowering rays. It will emerge therefrom south of the sun, after which the comet should be well observed from the southern hemisphere.

According to statistics prepared by W. E. Nichols & Co., of New York, there are eighty-three banks in New York city, having an aggregate capital of $98,872,700, and thirty-seven trust companies of New York and Brooklyn, with an aggregate capital of $43,000,000.

Correspondence.

Volcanic Eruptions.

To the Editor of the Scientific American:

Volcanic eruptions are the absorbing topic since the terrible calamity on the island of Martinique. Their cause and prevention furnish interesting problems for discussion. It seems to be the consensus of opinion that "water" is the "spark" which explodes these awful mines. The question which presents itself is: Is not this explosive agent automatic in origin; being in fact the lake of water which is generally found filling up the crater of the so-called extinct volcano? Following an eruption as a rule the volcano continues more or less active for years. Then an interval of inaction succeeds; during which the bottom of the now inactive crater fills up and becomes impacted and waterproofed with the accumulating detritus of years. The rains of many years following this period gradually collect and form the crater lake. This lake during another lapse of years slowly percolates and weakens some spot in its bed until sufficiently enlarged to suddenly precipitate its contents in the subterranean depths below. This event may be accelerated by an unusual atmospheric pressure.

If the above hypothesis furnishes the true cause, the prevention naturally suggests itself to be the emptying and future draining of the crater through a tunnel which would prevent any large collection of water.

B. S. P.

Savannah, Ga., May 19, 1902.

Lightning Effects.

To the Editor of the Scientific American:

Please give me an opinion through your paper on the following: On Friday night, May 2, a storm passed over our town, the lightning striking two trees, one with very peculiar results. A large red oak tree stood about 30 feet from a vacant house. The tree had a large slab torn from one side, the slab being about 25 feet long. The slab was broken into six large pieces and hundreds of small ones, some thrown a distance of 40 yards. One piece, 12 feet long, went entirely over the house; one struck a large tree near by; and the heaviest, 10 feet long and weighing about 70 pounds, struck against the closed shutters of a window, broke through shutters, sash, and glass, carrying all away clean; tore a large hole in the ceiling, then crashed into a window frame on the opposite side of the room. Now to the point. The timber doing the damage was a "stump piece," and had part of a root to it, the ground end having struck the house first. To do this it was thrown upward at an angle of about 35 deg., as the hole in the ceiling shows. My questions are these:

What force threw the timber? Was it steam caused by the heat of the lightning?

What caused the timber to fly upward?

Did the current run up the tree?

The force surely acted from below.

The tree has no marks above where the slab was torn off—is not shattered.

The lightning did not strike the house.

Gaithersburg, Md. S. A. Lehman.

[We must say we do not know to what the lightning owes its power to rend and split stones, trees, houses, etc.; not to steam in the case of dry articles, surely. That the electric current went from the ground to the cloud in this case seems certain. It does in many cases. Our professor in college said he always saw the lightning go up and never down. This is a mere result of habit of mind, since the flash is so sudden that no one can see it go in either direction, and any one may train himself to see it go in either direction. —Ed.]

Standard Time-Signals by Electric Light.

To the Editor of the Scientific American:

For many years the time-ball has been generally accepted as the standard form of apparatus for giving time-signals to the public. In most of the principal seaports of the United States are time-balls which are dropped exactly at noon by telegraph from an astronomical observatory. The signals thus given are of great public benefit, and are especially valuable to shipmasters whose vessels lie within sight of the ball. A time-ball, as usually constructed, is about three feet in diameter, and can be seen with the unaided eye at a distance of about two miles. The care and expense involved in its maintenance are such that it is usually impracticable to operate it oftener than once a day.

In a letter published in the Boston papers in April, 1901, the writer suggested the use of incandescent electric lights for giving time-signals, and proposed that the lamps used to illuminate the dome of the Massachusetts State House be utilized for the purpose. It was pointed out that such lights can be readily seen at a distance of ten miles or more, and that if operated automatically by telegraph from an observatory, they could be made to give standard time-signals which

could hardly be surpassed for accuracy and effectiveness. Because of opposition on the part of the Sergeant-at-Arms the plan was never tried at the State House, but is now about to be carried out at the Harvard College Observatory. Signals will be operated simultaneously in Cambridge and in Boston.

Such is the facility with which the electric current can be controlled by automatic devices that, telegraphic communication with an observatory having been once established, signals could be given at frequent intervals, for example, every five minutes, during the evening, instead of once a day, as in the case of the time-ball. It is, of course, essential that the telegraphic signals, in order to be of value, should come directly from an astronomical observatory, as it is only at such an institution that the time can be determined and kept with the necessary degree of accuracy. Three distinct plans are possible under the proposed system, as follows:

1. The signal could be given once each evening at a prearranged hour as, for example, nine o'clock. The lights, which would be burning before the appointed time, would be turned off by hand at about fifteen seconds before nine. The controlling switch would then be connected with a telegraphic instrument operated from the observatory. At precisely nine o'clock a signal from the observatory would release the switch, causing the lights to flash into full brilliancy. This method, which is similar to that employed for the time-ball, would require the services of an attendant. It would have an advantage over the time-ball in that the radius of visibility would be much greater.

2. Auxiliary clockwork located near the lights could be made to turn them off a few seconds before the appointed time, and in so doing, connect them with the observatory instrument which would light them again at the proper instant, the entire operation being repeated at intervals of five minutes. By this plan the apparatus would be entirely automatic, and would require no attendant.

3. A specially constructed relay could be operated by the observatory circuit, causing a momentary interruption of the lamp current in response to every signal received from the observatory. Most observatory clocks give signals continuously, at intervals of one or two seconds, a pause preceding the sixtieth second to mark the minute. The Harvard signals, which have been extensively copied elsewhere, are given every two seconds, one beat being omitted before each minute, and twelve beats every five minutes. Thus, a person having the time within thirty seconds can correct his timepiece by waiting for the pause marking the minute. If the error of the timepiece is not known within thirty seconds but is known to be within two and one-half minutes, it is necessary only to wait for the long pause marking the fifth minute. Tests made at the laboratory of the Harvard College Observatory have shown this method to be remarkably effective; and it is probable that the signals to be established in Boston and Cambridge will be operated upon this plan.

It is evident that the new system is applicable to any number of lamps. A single lamp may be used for local purposes, in the street, or at the entrance of a public building, or several hundred lamps may be employed, giving a powerful light which can be seen for many miles. When the radius of visibility of such a light is considered in connection with the frequency with which the signals can be given, some idea of the efficiency of the system may be obtained. Moreover, it is not necessary that an expensive plant should be established especially for the purpose. The towers and domes of many large buildings are already illuminated for spectacular purposes. The equipment thus used could be utilized at trifling expense without materially altering their construction. A signal established at some point in New York harbor as, for example, on the Statue of Liberty, would be of inestimable value to the shipping interests, and would become a most striking and interesting landmark.

It may be argued that lights can never take the place of the time-ball, as they cannot be seen by day. Experience seems to show that the use of a standard time signal at midday is largely a matter of habit, arising probably from the old custom of ringing bells at noon. For most purposes almost any other time would answer equally well. The new system is not, however, designed to necessarily supersede the time-ball, but may, if desired, be used as a separate and supplementary service, having far greater efficiency.

WILLARD P. GERRISH.

Harvard College Observatory, Cambridge, Mass., May 23, 1902.

The Current Supplement.

The leading article of the current SUPPLEMENT, No. 1380, is devoted to a discussion of the occurrence and distribution of corundum in North Carolina and Georgia. The article is accompanied by four illustrations. Results of a most careful research in experimental phonetics are told by Prof. John G. McKendrick. The paper is one of the most important which has appeared on the subject of acoustics for years. The many illustrations presented do much to elucidate the text. Dr. Perrine concludes his interesting account of the power plants of the Pacific Coast. Striking illustrations accompany his description. Dr. Soper tells of the sanitary measures to be adopted after floods. The Hon. Carroll D. Wright writes interestingly of the use of statistics. The usual trade notes and consular matter will be found in their accustomed places.

THE MODERN USE OF ELECTRICITY IN PRINTING.

BY FRANK C. PERKINS.

It is certainly surprising to note to what extent electricity is now used in the leading printing establishments of this country, as well as in Europe. It is with a deep feeling of pleasure when one steps from the old-fashioned belt-driven pressroom into the modern, clean, bright, well-lighted, motor-driven pressroom of an up-to-date printing plant. The dark, ill-smelling, poorly-ventilated, dingy basement printing shop is now radically changed, it being noted that electricity has been the wonder worker, and is now supplying current for lighting the various departments with brilliant arc and incandescent lamps. The foul odors are dissipated and driven out of the workrooms by powerful electric fans and motor-driven exhaust blowers; the fast-flying belts which endanger life and limb, with the numerous countershafts and pulleys, have disappeared, and in their place are to be found separate motor-driven machines of every type and kind known to the modern printing trade.

In the typesetting room the electric motor is geared to the linotype machine, and the composition is accomplished with great accuracy and dispatch; the type-casting machines are operated by dust-proof electric motors, and direct-connected routers and metal saws are at work, saving power and economizing space and increasing the product in a given time. The electroplating branch has always been an important application of electricity in the printing industry.

In the pressroom the motors are connected to the various machines either by belting, by gears, or by being directly connected to the press, the latter being accomplished in many cases by simply removing the tight and loose pulleys, which were used for driving by belts from the main shafting, the motor simply being substituted.

The advantages of direct connection are many, including noiseless running, simplicity of construction, reduction of losses from friction, and slippage of belts, while the space in the pressroom required is less and the life of the motor is greatly increased, largely due to its slow speed. The automatic folders are frequently driven by the electric current, and the modern paper cutter is also operated in this way with great reliability and safety, it being possible to stop the cutting machine instantly if desired.

In the binding department there is probably as great a field for the electrically driven machine as any in the entire printing establishment. The embossing presses of the latest types, as well as the binding machinery, cutting machines, stitching machines, and graining machines, are electrically driven, producing a great saving in power, which is used only in proportion to the work done. It is not necessary to supply power for the whole plant when only one or more machines are working, as the moment the operator breaks the circuit the motor stops and all of the expense immediately drops off. With shafts, pulleys, and belting this is not the case, as there is a continual loss due to the friction in operation of same when there is no load, and the losses due to slip of belt are continually varying from month to month, due to variation of tightness of belt, arc of contact, and smoothness of the pulley faces. On account of the settling of floors and walls, the line shafting is bound to get out of alignment more or less, which also is a great source of loss. The entire belt transmission system is continually becoming clogged and covered with dirt, grease, and flying dust, while the motor-driven machines result in greater cleanliness, a saving in the cost of insurance on account of decreased danger from fire, and a greater amount of light, due to the entire absence of these overhead obstructions. Electric heaters are now being installed in many binderies, and electric motors can be adopted with great economy and many advantages by every printing establishment in the country, and there are a large number now fully equipped with this system of driving. The work of the printing press is bound to be more or less intermittent, which always results in a saving in motor-driven machinery, this being largely due in this class of work on account of the necessity for stopping to "make ready." It is also true that for the preliminary impressions the press must be run very slowly, and frequently started and stopped, and this cannot be so well accomplished by mechanical drive, although later the speed may be increased to a maximum limit, turning off thousands of impressions in a short time.

The Bureau of Engraving and Printing at Washington, D. C., is thoroughly equipped with electrically-driven machines operated by General Electric motors; and many of the leading newspapers and magazines have had their plants equipped with Lundell, Northern and Bullock machines, these types of motors having been extensively used for direct connection, as well as by gearing and belt driving, to most of the high-grade presses, cutting machines, routers, stitching machines, and other devices used in an up-to-date printing establishment.

It is not always the high speed of a press which produces the greatest amount of work, but the one which can be kept operating continuously at a comparatively rapid rate without a great number of stoppages, from various difficulties, a great amount of time being lost.

The breaking of belts and other faults due to bad power transmission causing delays require a greater speed from the press to make up, while a moderate speed under continual operation means greater economy, increased output, and less wear upon the machinery.

It is very easy in many cases to equip an old printing establishment with electrically-driven presses without discarding existing valuable apparatus. In these cases it is found very convenient and desirable to use a short, endless belt to connect the motor with the press, the standard press pulley being used, and no changes are required on the press. This method frequently allows placing the motor under the press, and no valuable space is thus occupied. The geared outfits and direct-connected outfits are, of course, the most substantial, the latter being really the ideal method, although the cost is considerably higher, as very slow-speed motors are required.

The direct-connected outfits have the armature of the motor attached directly to the driving shaft of the press without the interposition of gears or other transmitting mediums. The armature must, therefore, run at the required speed of the press shaft, which is usually very much lower than that of the ordinary electric motor.

The accompanying illustrations on our front page show several German direct-connected motors built by Schuckert & Co. of Nurnberg operating high-speed presses of the Frankenthal type.

The first cost of the motors for the geared and belted outfits are much lower than the direct-connected type, and the first cost of electrically operating with any type of motor is, of course, more than the old belting and shafting transmission. The advantages to be gained by the former over the latter, even at the added cost, are well worth the increased expense, on account of the saving of the great friction losses, economy of floor space, noiseless running, and greater reliability and safety.

The cost of equipping a printing plant is greater, as the use of the booster teaser, in addition to the motor, increases the expense of the electrical machinery by that amount; but as in the case of the advantages of the direct-connected, slow-speed motor over the high-speed belted or geared motor, the increased first cost is more than made up in the saving in current and other features.

Bird's Eye Maple.

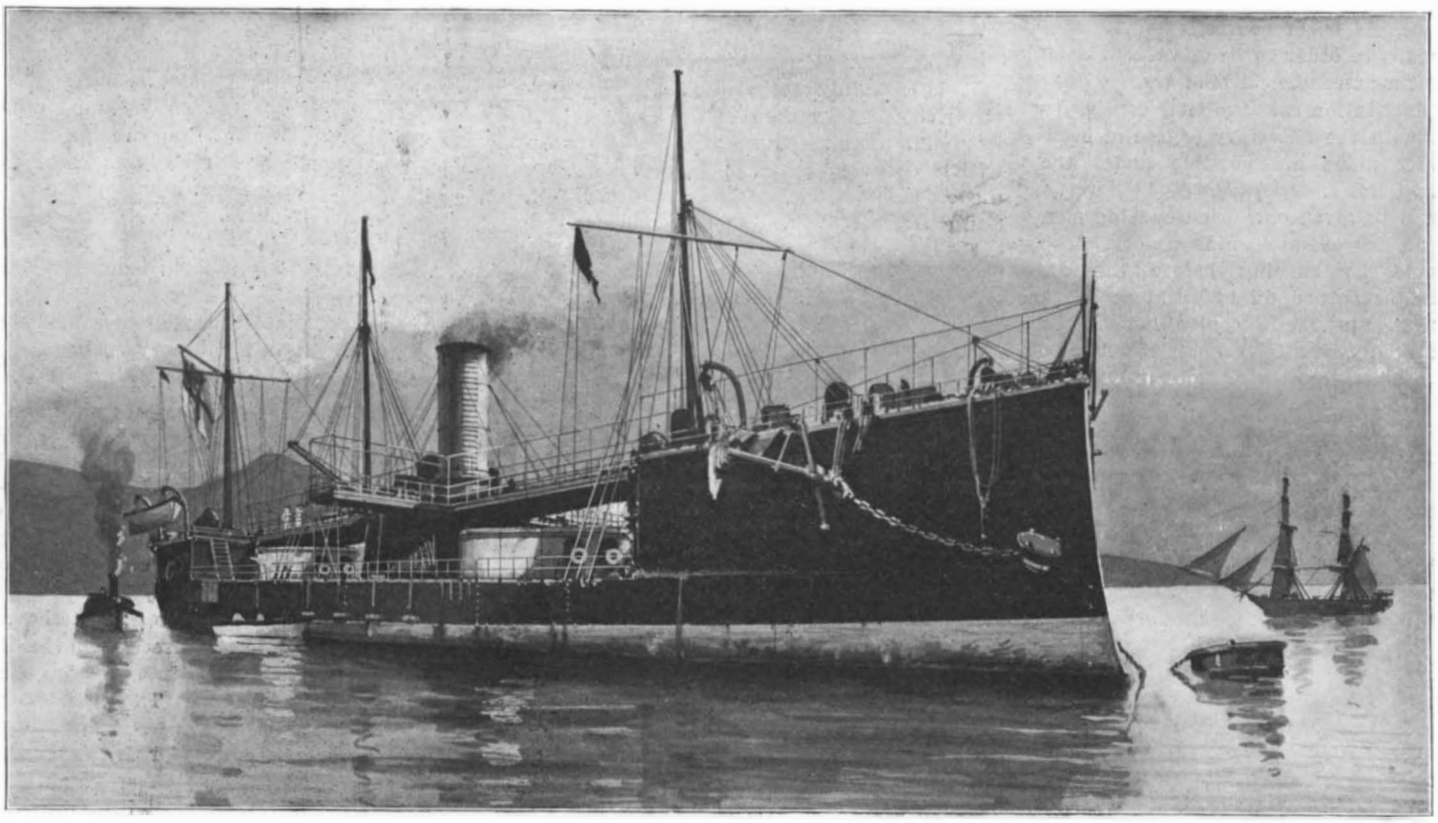
What is bird's eye maple? That is a question which just now seems to be baffling not only people who use furniture made of this particular wood, but even woodworkers themselves. In a recent number of a woodworking magazine an article was published which stated that bird's eye maple was not a peculiar maple, but simply ordinary maple cut in a certain way. In a recent issue of the New York Sun that statement is refuted. It is there stated, on the authority of a woodworker, that bird's eye maple and curly maple are both cut only from the logs of the rock maple tree, *Acer saccharinum*, in which a beautiful lustrous grain is produced by the sinuous course of the fibers. This tree is not at all the common hard maple. It is a hard maple, but is full of little gnarls called eyes. Men looking for bird's eye maple logs go through the standing timber and pick out the bird's eye maple trees, paying for them from $30 to $50 a thousand feet in the woods. Ordinary hard maple logs are worth only from $6 to $7 a thousand feet. It would be impossible to cut a piece of veneer with eyes in it from a common hard maple log, and would be equally impossible to cut a bird's eye maple log, no matter how you cut it, so that it would not show the eyes.

The first sod of the new dock at Avonmouth, Gloucestershire, England, on which the sum of $10,000,000 is about to be spent, was turned on the afternoon of March 5 by the Prince of Wales. It is hoped that a portion of the American traffic formerly enjoyed by the port of Bristol will be recovered by the building of the new dock. In 1893 the corporation of Bristol presented a bill to Parliament asking for power to build a new dock at Avonmouth, large enough to accommodate at one time three of the largest Atlantic liners then afloat. After nine years of earnest effort, work has now begun.

EARLY BRITISH DOUBLE-TURRETED MONITORS.

During a visit of Said Pasha, Viceroy of Egypt, to Europe, in 1862, he inspected the shipyard of Messrs. Laird & Co., Birkenhead, England, and on his return home gave an order for the construction of two ironclads by Laird to Mr. Broway, a French merchant who was well known in the East through his business connections with the Egyptian government. Before the ironclads were completed the Viceroy died, and his successor, Ismael Pasha, declined making the necessary payments on the vessels to Mr. Broway.

Through the influence of the French Emperor, Ismael Pasha was brought to terms, and Mr. Broway, in consideration of a payment of $250,000, assumed the contract for the ships himself. But it was arranged that the transfer of the contract should be kept secret and that the ironclads should continue to be known as the Viceroy's property.



Length, 224½ feet. **Beam,** 42 feet 4 inches. **Draft,** 17 feet. **Displacement,** 2,750 tons. **Speed,** 8.5 knots. **Armament:** Four 9-inch muzzle-loading guns. **Side Armor,** 4½ inches.

THE "SCORPION," AN ENGLISH DOUBLE-TURRETED MONITOR OF 1863.

The motive of the above arrangement is found in the fact that the vessels were actually destined for the use of the Confederate States; and early in September, 1863, the United States Consul-General at Alexandria was informed that the two ironclads were completed and would sail as ostensibly belonging to the Egyptian government, unless evidence of the real ownership and destination of the vessels could be presented. To secure this evidence was a task as delicate as it was difficult, as it could only be given by the Viceroy. In the absence of Consul-General Thayer, his substitute, Mr. Francis Dainese, obtained an interview with the Pasha, and made it clear to him that the two ironclads were to be delivered under his name to the Southern States. As a result of the clearness with which it was made evident to Ismael Pasha that unless the plot were disavowed his government would be placed in an extremely compromising position, the Pasha officially declared that the Egyptian government was not in any way connected with the two ships. On the 11th of September, 1863, Mr. Dainese telegraphed to London the facts of the official denial by the Egyptian government, and shortly after this the two ships were seized by the British government.

The vessel shown herewith was originally known as "El Tousson," and her sister ship as "El Monassir." After their seizure they were purchased by the British government and incorporated in the Royal navy under the respective names of "Scorpion" and "Wivern." They were launched July 14, 1863, and for many years past they have been doing guardship service. The vessels were 224 feet 6 inches in length, 42 feet 4 inches in beam and their draft was 17 feet. Single screw engines of 1,000 indicated horse power gave them a speed of about 8.5 knots an hour. The "Scorpion," which was 2,750 tons displacement, carried a crew of 151 men. For a great many years past she has acted as depot ship at Bermuda. She was built of iron and carried two turrets which were disposed on the center line of the ship, one forward and one aft of the smokestack. The freeboard amidships was low, the vessel in this respect approximating to the monitor type, but she had a high forecastle deck and poop, features which, of course, gave her a great advantage in a seaway over the monitors of the Ericsson type. Each turret contained two 9-inch muzzle-loading guns.

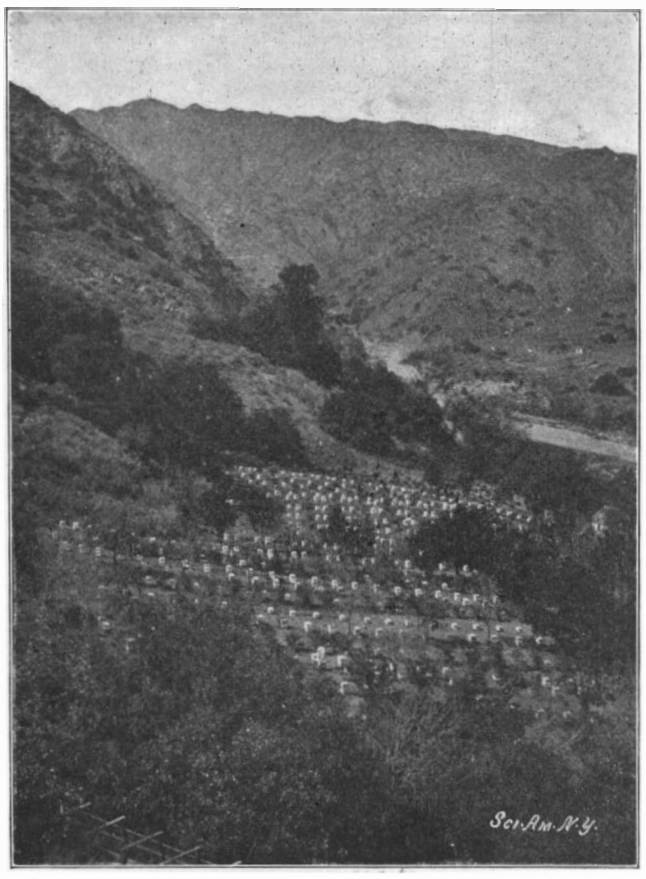
When we bear in mind the low freeboard and unseaworthy character of the earlier monitors to which these ships would have been opposed, had they reached their destination in the Confederate navy, it must be confessed that they would probably have proved more than a match for the Northern craft, and that the subsequent course of the naval campaign might have been considerably modified.

BEE-CULTURE.

BY W. FRANK M'CLURE.

There is no more charming and interesting rural study than that of the habits and occupation of the busy honey-bee. With the coming of the warm summer days in the country she is everywhere present, though so small as to attract little attention in comparison with the domestic animals of the farm, the birds of the air or the game of the woods. Did you ever stop to think that these little beings of earth's creation possess an anatomy astonishing in its intricate construction, that they are subject to many of the ills of man, that their sagacity is almost equal to that of a dog or a horse, and that their dispositions vary and are susceptible to many influences? As workers of the insect world they are only equaled by the ant, to which for wisdom Solomon directed the attention of all posterity.

The older inhabitants of rural America remember the bee as found wild in the woods. They recall the interesting and often exciting experiences which followed an attempt to secure the honey of these wild bees. Bee-hunting is not an altogether obsolete pastime, although little is said about it to-day. There are thousands of bee-trees in the United States to-day which inclose vast stores of honey. Honey from bee-trees is secured sometimes by felling the tree, sometimes by scaling its heights and, after extricating the sweet harvest, lowering it by means of a rope attached



A TYPICAL CALIFORNIA APIARY.

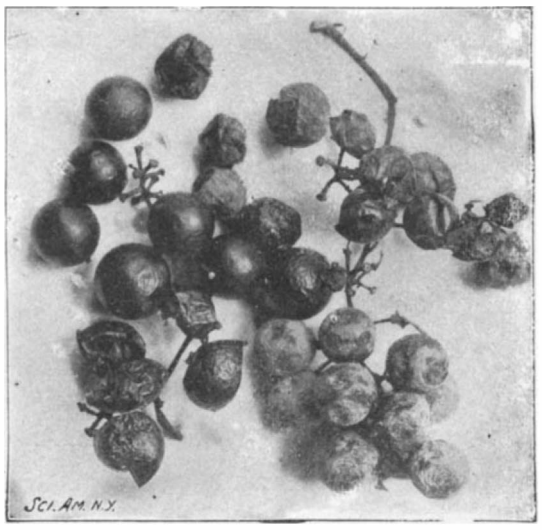
A WORKER BEE AND ITS STING.

A WORKER WITH A DRONE ABDOMEN.

A DRONE WITH A WORKER ABDOMEN.

LOWERING PAILS OF HONEY FROM A 100-FOOT BEE-TREE.

to pails or baskets. This wealth of honey is often found at a great height, and it is no easy matter to battle with the bees in such quarters. Skilled bee-hunters, nevertheless, often secure not only the honey, but also the bees. After reaching an elevation on a level with the hive, the top of the tree is sawed away close to the home of the bees. Then the tree trunk is severed again just below the hive. The hive is in the hollow of the trunk and the entrance is, many times, through a knothole. Then the entrance is cov-



THE SHRIVELED GRAPES HAD BEEN PRICKED WITH A PIN AND WERE SOUGHT OUT BY THE BEES. THE PERFECT FRUIT IS UNTOUCHED.

ered with a wire netting, the screen of which is sufficiently small to imprison the bees, and this natural hive of the woods is lowered to the ground.

This interesting pastime of hunting the homes of wild bees is pursued with care and in accordance with a knowledge of the habits of the little workers. When the bee has found profitable honey-making territory, she sizes up the location. In taking wing she circles in the direction of her home, with each circle approaching nearer and nearer her hive in the tree until, all of a sudden, she makes a "bee-line" for the tree. The wild-bee-hunter must be enabled to watch carefully the direction in which this bee finally goes, and he can usually depend on it that the destination is not more than a mile or two away. The exact distance is sometimes ascertained by timing a bee, giving it five minutes to go a mile, and two minutes to unload its honey. A particular bee is distinguished by touching it with a drop of white paint while it is engaged in gathering honey.

The accompanying photograph of a bee-tree, cut down and with a part of the honey taken out, shows a company of children enjoying the sport, but without veil or other protection from stings. Those who know say that, contrary to what we might expect in this regard, the bees are not to be feared after the tree has been felled. The fall of their high quarters has the effect of stunning them. However, it is not always best to take risks in handling the bees themselves unless one is an expert, for bees will always sting when pinched.

Some folks who handle bees extensively become very much attached to them, and they resent the idea that the bee is vicious. In fact, they go so far as to claim that bees are gentle and not prone to anger when handled with knowledge, care and consideration. The knowledge which is required should include a realization of the species to which the little workers to be dealt with belong. Nationality here counts for as much as it does in the human family. The black bee, so common in this country, is much more easily stirred to anger than the Italian bee. The black bee is also known as the German bee, and the cross between the black and the Italian is commonly styled a hybrid—a more vicious species by far than the black bee. In all nationalities, as before stated, there is a difference in disposition. The members of each colony have a personality which the experienced handler of bees can detect. The man or woman, boy or girl who grows up to know the peculiarities of his various colonies solves many problems. Here, too, pedigree counts. It will doubtless be news to the general reader to know that apiarists sometimes purchase queens at a cost of $25 each, and that there is at least one queen bee in the United States valued at $200, and yet the life of the average queen does not exceed four years.

Speaking of the age of a queen, it is of additional interest to realize that the average life of the honey-bee, a worker, is seldom more than two or three months in summer, depending upon its activity. In the height of the honey-making season it often exists but six weeks. It simply works its little body out. When about ready to die, its silken wings will be found ragged and half gone. However, when young bees hatch out in September and October and go into winter quarters, they will probably live until the following April or May. The life of the lazy drone is no longer than that of the average bee, but this, of course, is not on account of overwork. The drones are usually killed. The busy workers cannot tolerate them about. In every instance it is a queen, not a king, that rules over this form of God's creation.

When the resources of honey are scarce, it is then that the bees, having little to do, are likely to form bad habits. It is then that they get to robbing. One of the number may somewhere find that there is honey to be had in large quantities in the hive of a nearby disabled colony or, perhaps, through the open door of the honey-house of the apiarist. The capacity of the honey-bee for honey is about the size of a small pea. To extract this load from the flowers often requires a bee to work for a full day, while, if she can get it from a hive or storehouse, she can fill in a few minutes. Robber bees in visiting another hive are met by sentinels and scouts, but these they soon overpower if the colony is a weak one.

It is a peculiarity of bees that when robbing they become very angry. They attack everything and everybody. An amusing incident is told concerning the experiences of an apiarist at Groton, N. Y., in which the bees figured to the extent of tying up an entire line of railroad for several hours. A box car containing some honey was broken open in a wreck and some of the honey scattered. A bee on its homeward journey discovered that great quantities of rich honey were to be had within a few hundred feet of the home of many colonies. It filled up to its fullest capacity, and started for its hive. On entering, the bees noticed that it carried an extra large load. They cleared the way for it to pass and, after it had deposited its precious load in a cell of the comb, followed it out into the open air. They followed it to the car, and soon the news passed about from colony to colony, until the broken box car was filled with bees. The engineer and fireman, and eventually the entire train crew, were finally driven from the train by the angry robbers. The apiarist found it necessary himself to mount the engine and, taking hold of the throttle, haul the broken car a mile away. Several days were required to again secure peace and quiet in the apiary.

In another instance, at Medina, a little country town in Ohio where there are extensive apiary interests, a quantity of extracted honey was spilled in a box car on a branch of the Baltimore & Ohio Railroad nearby. The apiarists knowing that if the bees got a taste of the honey there would be serious results, sought to

HANDLING A SWARM OF BEES.

cover the sticky floor with sawdust. The bees, nevertheless, found the spilled honey, and thousands of them were soon busy burrowing in the sawdust. For weeks afterward these bees could be seen examining each box car left on the siding, and when one day one was found with sawdust upon the floor, they crowded to it and burrowed in the sawdust just as they had done in the car of honey, thus showing their sagacity.

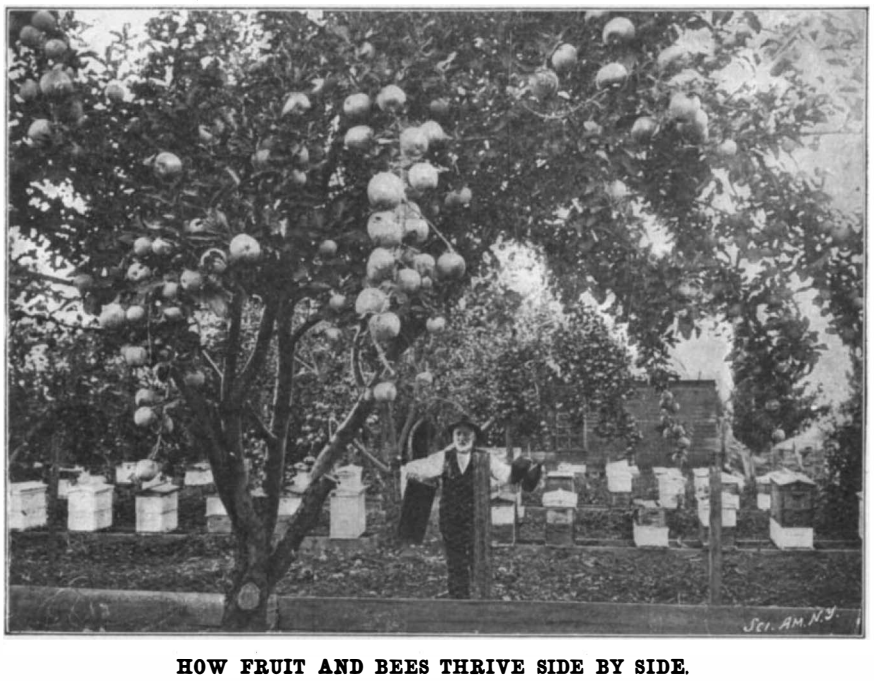
The manner of communication which one bee must have with another is not known. Men of twenty-five and thirty years' experience in the apiary are unable to definitely solve this problem. It is likely that they have some form of communication in sound. The bee makes its sounds with its wings. In robbing the note is a high one, and can readily be distinguished. In time of swarming the old method of bringing down a cluster of bees and hiving them consisted in beating pans and ringing bells. The efficiency of this consists in disorganizing a swarm by keeping the bees from hearing the distinct sound made by their queen.

Swarming is an interesting time in the haunts of the honey-bee. It usually occurs in the honey-making season of May or June, and often in July. The natural conditions which lead up to swarming comprise the crowding experienced by the bees as their storehouse of honey becomes full, and as their numbers multiply. A few days before they are to swarm they will gather little or no honey, but will hang about, often on the outside of the hive, until with one accord they rush out into the air and, after circling about for a few moments, finally alight upon a tree and there form a great cluster. Here they may remain anywhere from fifteen minutes to four days, but as a rule they start for the woods within two hours. The tree in the woods on which they alight is one previously selected by the scouts.

To place the queen in a new hive is to hive the bees, for they will always follow their queen. There is not much danger in handling the bees at swarming time. Then they are not usually cross. Women are often as proficient about handling swarms as are men. Many of them work without veils. An important rule to follow consists in appearing unconcerned when a bee seems about ready to make an attack. The outstretched hand should not be withdrawn quickly but rather allowed to remain. There is less danger of being stung. I have seen apiarists place their hands gently upon a hundred bees without being attacked.

The human breath is very offensive to bees, likewise the breath of an animal. It makes them very cross. They, too, have a great antipathy for hair. Both of these dislikes seem instinctive. In the early days of the country the bear

REMOVING WILD HONEY FROM A FELLED BEE-TREE.



HOW FRUIT AND BEES THRIVE SIDE BY SIDE.

was a natural enemy of the bees. Bruin was always seeking to satisfy his love for honey, and would rob hives of wild bees fearlesly. Other natural enemies of the bees are ants, kingbirds, mice, skunks and toads. It is not an unusual sight to see a toad sitting in front of a bee-hive and swallowing the bees as fast as he can catch them coming out.

It requires some 20,000 bees to make a pound of honey in a day. Honey, as we all know, comes from very many different flowers and plants. It is obtained from white and red clover, sunflower, buckwheat, fruit blossoms, basswood blossoms, dandelion, goldenrod, and even blossoms of the turnip. In the West, alfalfa is found to be a great honey-producer. The flower of alfalfa resembles much our sweet clover blossoms of the East. The cacti of the West is also a honey-producing plant.

In gathering honey from these sources the bee uses its wonderful tongue, the anatomy of which would form an interesting day's study for any student of the insect and animal world. The bee has a true stomach and a honey-stomach. In the honey-stomach the nectar is separated from the pollen, the pollen being cared for by the true stomach. In the study of the bee's anatomy it will also be found to possess a brain and a nervous and a respiratory system. Its compound eyes are alike wonderful. In comparing its ills to those of man it may be noted, for example. that the bee suffers from paralysis. Remarkable, too, it is that the bee makes a product which no manufacturer can duplicate, at least as far as putting it in combs and capping it is concerned.

There is a common belief abroad that when a bee stings it soon after dies. This nowadays is generally discredited, though in some instances bees do die from this cause.

It has been claimed that fruit and bees cannot exist in the same farmyard, but this is false, a fact illustrated in one of the accompanying photographs. Bees are not the enemies of whole and perfect fruit. They are not the first to puncture a grape, although, because of their conspicuousness on and about grapes, they are often blamed for so doing. It is oftener a bird that first attacks fruit. The bee then seeks honey through the opening thus made.

Bee-keeping nowadays has resolved itself to a science, and, in many sections of the country, an extensive industry. There has been a very marked evolution since the time when bees and honey were to be found in the woods only. Modern inventions and genius are to-day assisting both the bee and the apairist. The annual consumption of honey in the United States aggregates nearly 125,000,000 pounds.

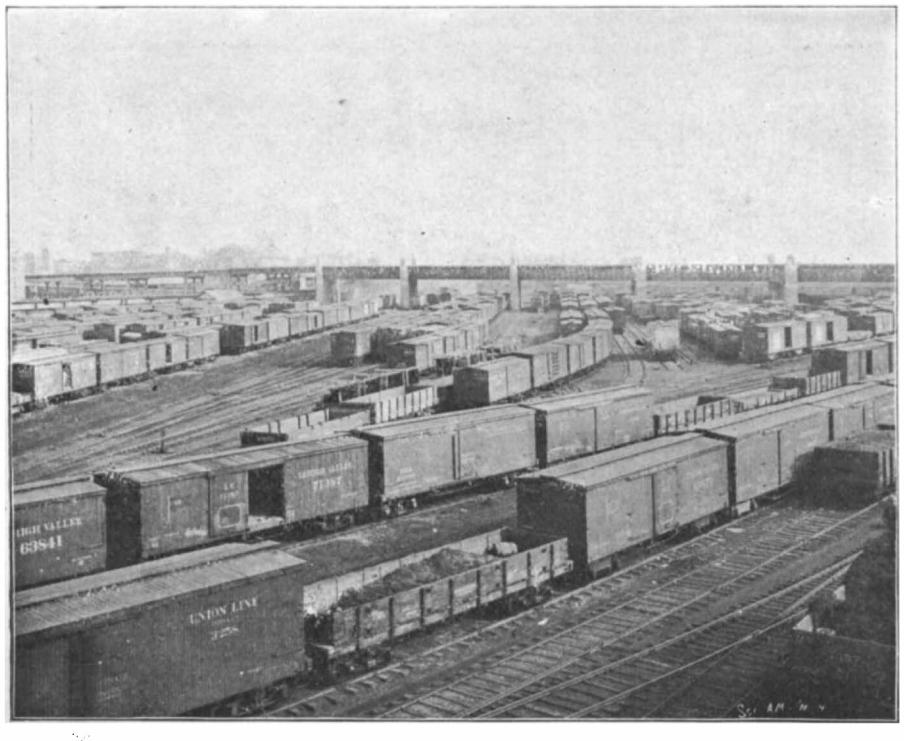
RAILROAD FREIGHT HANDLING IN NEW YORK CITY.

New York city is the only prominent port in the world where freight cannot be delivered directly from the railroad to the ship, or *vice versa*. The deep, broad body of water which surrounds the island of Manhattan affords excellent wharves and docking facilities, but at the same time cuts off direct connection with the railroads. Of the ten trunk lines which deliver goods at this harbor, only one enters this city, the other nine having their terminals on the Jersey shore. Thus, the greater portion of the freight is received in Jersey City and shipped from New York, while Brooklyn is used as a warehouse in which the goods are stored. This unique state of affairs has developed an elaborate system of lighterage and "floatage" peculiar to this harbor.

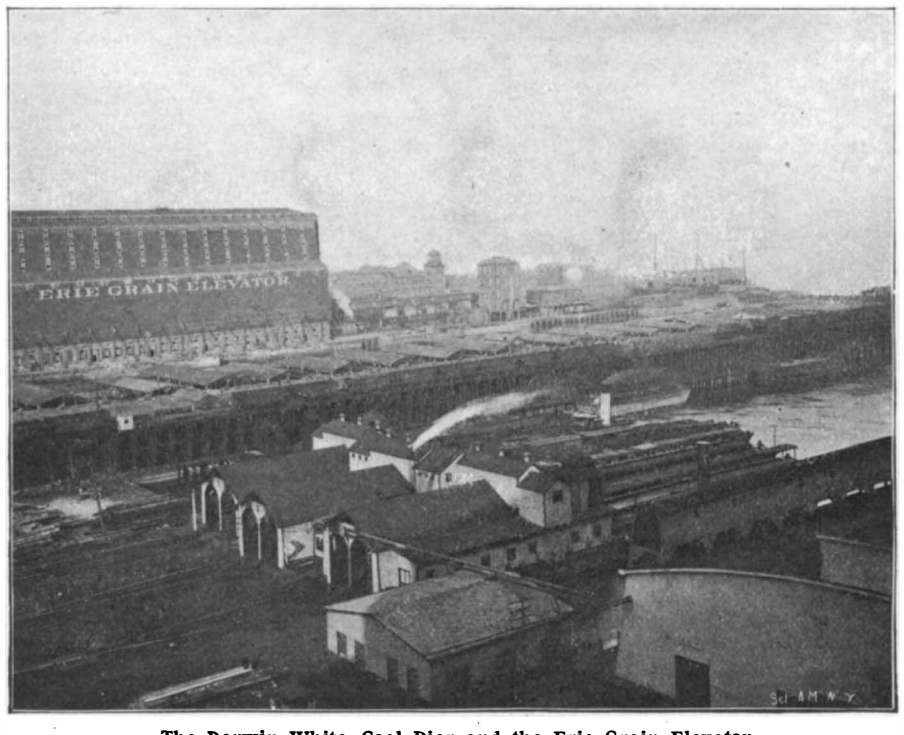
In earlier times warehouses were built on the Jersey side of the North River, and freight was transferred by lighters to and from piers on the New York side. This system, however, was replaced by the present one, in which the loaded cars themselves are ferried over on floats and their contents delivered to steamer or wharf without landing the car.. The cars are thus transported to Brooklyn also, where the freight they carry is stored in the warehouses. Another branch of the work is the transfer of freight from one railroad to another. A number of lighterage companies have been formed which do the lightering for the railroads.

Many lines, however, do their own lightering. One of the best equipped railroads for this branch of the work is the New York, New Haven & Hartford Railroad. This road does an enormous business in transporting raw material from the West and South into New England, and in the subsequent return of the same material manufactured into the finished article. All this through traffic must be transferred around Manhattan Island. It is essential, therefore, to the life of the road that its tugs and floats should be among the largest and best in the harbor. The company owns a great number of floats, three of which are the largest on the river, having a capacity of twenty-two cars each. The tugs are also very powerful, some of them being fully capable of handling singly a pair of the twenty-two-car floats. The fast freight, however, is carried by two steamers, "Express" and "Maryland," which make the trip down the crowded East River, around the Battery and across to the Pennsylvania yards, a distance of 12 miles, in the exceedingly short time of 52 minutes. The steamers are both modern steel vessels, provided with electric steering gear. The "Maryland" is fitted up with a fine dining room, for in addition to her freight duties she carries daily two passenger trains, the Federal express and the Colonial express. Aside from the through traffic, however, local freight forms a large part of their tonnage. The Berkshire milk arrives at the Harlem River terminus every night at 10 o'clock, and the fish train at 1:30 A. M. Of the four yards, the one shown in the illustration is situated in the very heart of the piano industry, consequently a large part of the freight here handled consists of pianos, which are shipped daily into New England in great numbers.

But aside from the subject of lightering, it will be interesting to look into the method of handling cars,



The Harlem Yard of the New York, New Haven and Hartford Railroad.



The Berwin-White Coal Pier and the Erie Grain Elevator.

Upper Jersey City Yard of the Pennsylvania Railroad.

Lower Jersey City Yard of the Pennsylvania Railroad.

preparatory to floating them. The most up-to-date method of drilling cars is in the use of the gravity system. This is well illustrated in the two Jersey City yards of the Pennsylvania Railroad. The tracks which enter the upper yard are elevated in order to avoid grade crossings in the city, and this elevation forms the starting point for an incline which leads down through both yards to the water front. The incoming freight trains are halted at the top of this incline, and there the work of the drilling engine begins. The engine and a "poling" car connected to it run on a track parallel and adjacent to the freight train. The poling car is a flat car on which a lever or "pole" is mounted. The pole is arranged to swing laterally, and is under the control of a conductor, who rides on the car. The conductor, who has a list of the cars and the destination of each, guides the pole against them consecutively, whereby they are given a start down the incline. Each car is controlled by a brakeman, or "rough rider," as he is called, who receives his instructions from the conductor, and who, by certain gesticulations and signals, makes known to the switchmen along his course which pier he is bound for.

A large portion of the upper yard is occupied by the coal traffic. The modern large, steel gondolas are too heavy to be carried loaded beyond tidewater. They are consequently run out on the Berwin-White pier shown in one of our illustrations, and their contents dumped into barges or lighters, which convey the coal to its proper destination. These two yards, however, are insufficient for the immense freight traffic of the Pennsylvania Railroad. A large yard nearly two miles long is situated on the Jersey Meadows near Newark, and here also the gravity system is used.

The grain trade forms a large part of New York city's freight traffic. One of our views shows the Erie grain elevator at Jersey City. Cars loaded with grain are run into the elevator and unloaded, their contents being weighed and placed in bins according to grade. The consignee is then notified of the arrival of his grain, and, at his order, the railroad company lighters it free of charge to any vessel or delivery point in the harbor.

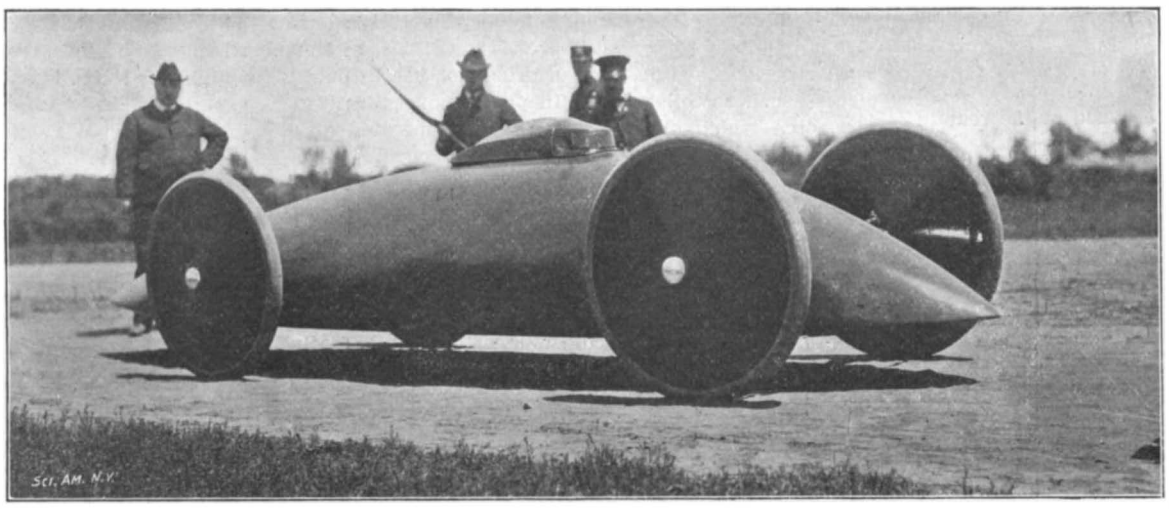
An interesting feature of the Erie freight traffic is the fruit auction carried on daily in their New York depot. The Erie Railroad makes a specialty of California fruit, bringing in oranges and grape fruit in great quantities during the winter, and in the summertime plums, peaches, grapes, etc. In order to increase this business, the company provides an auction room where the fruit is auctioned off to jobbers and owners of fruit stands. Thus in certain seasons an average of thirty carloads are disposed of daily.

It would be impossible to give a detailed description of every trunk line entering the city, and its individual capacity and method of handling freight. This article is designed to give the reader merely a general idea of a subject which, though very interesting, is nevertheless too little known by the general public.

The pension roll at the end of the last fiscal year included more names by 4,206 than at the corresponding date the year before, says Bradstreet's. The list included 907,735 names on July 1 last. There were added to the rolls during the year the names of 44,225 new pensioners, while those of 3,567 were renewed and restored. In all, 43,586 names were dropped, of which 38,152 were in consequence of death. As a result of the war with Spain 5,604 names were added. The total amount disbursed was $131,568,216. Attention is directed by Com. Evans to the unsatisfactory circumstances attending the medical and legal adjudication of claims for pensions, and he makes some recommendations looking toward improvement which are deserving of consideration. One feature of the proposed plan is the constitution of traveling medical examining boards not affected by local interests.

THE BAKER ELECTRIC RACING AUTOMOBILE.

An apparent confirmation of the old superstition that accidents occur in threes is to be found in the fact that within the past month there have occurred an explosion on the submarine boat "Fulton," the destruction in mid air of the airship "Pax," and the demolishment during a speed trial of the Baker electric racer, illustrations of which we give herewith. By these three accidents, submarine navigation, aerial navigation, and the new method of locomotion on the earth's surface have each received a blow from which they will not soon recover. Of the last two accidents is this especially true, since each of them caused the death of two persons. In the case of the airship, the daring aeronaut and his helper were killed, while the automobile accident resulted in the death of two onlookers and the serious injury of half a dozen others.



ELECTRIC RACING AUTOMOBILE BEFORE THE WRECK.

The Baker machine is the second electric racer of peculiar construction that has attempted to make a record on a straightaway mile course within a year. A machine constructed by Mr. A. L. Riker, and at the time illustrated in these columns, made a record of a mile in 1 minute 3 seconds at the Automobile Club of America's speed trials on the Coney Island Boulevard last fall. Mr. W. C. Baker, another pioneer in the electric vehicle field, and a skilled mechanic and electrician, constructed a second racer for the Automobile Club's speed trials on Staten Island, with the hope of making a new record. The machine was built on much the same lines as the Riker racer. It consisted of a stout angle iron frame, tapered inward slightly at both ends, with two low seats for the occupants in the center. A single electric motor behind the two men was geared by two chains to spring-mounted sprockets on the rear axle, to which were also fastened the band-brake drums. The frame was mounted on four 36-inch wire wheels with wood rims and 3-inch pneumatic tires. The wheels and axles were sufficiently heavy and substantial to carry the 3,000 pounds of weight in the motor, batteries and controlling apparatus under ordinary running conditions. That two of them survived the strains of the accident speaks well for their staunchness.

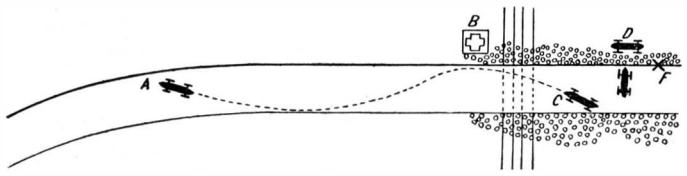


Diagram Showing Course of Automobile Just Before the Accident.

The electricity to run the racer was furnished by 40 cells of Gould light-weight, lead-zinc accumulators, capable of giving for a short time the heavy discharges necessary to attain high speeds. The cells were assembled in eight crates, six of which contained five cells, and the other two, four and six respectively. Two five-cell crates were placed longitudinally of the vehicle at the front end, one being on each side of the inclined steering post; three were placed at the back and sides of the operators' seats, in the shape of the letter U; and the remaining three were set transversely, one between the motor and the rear axle, and two behind the latter.

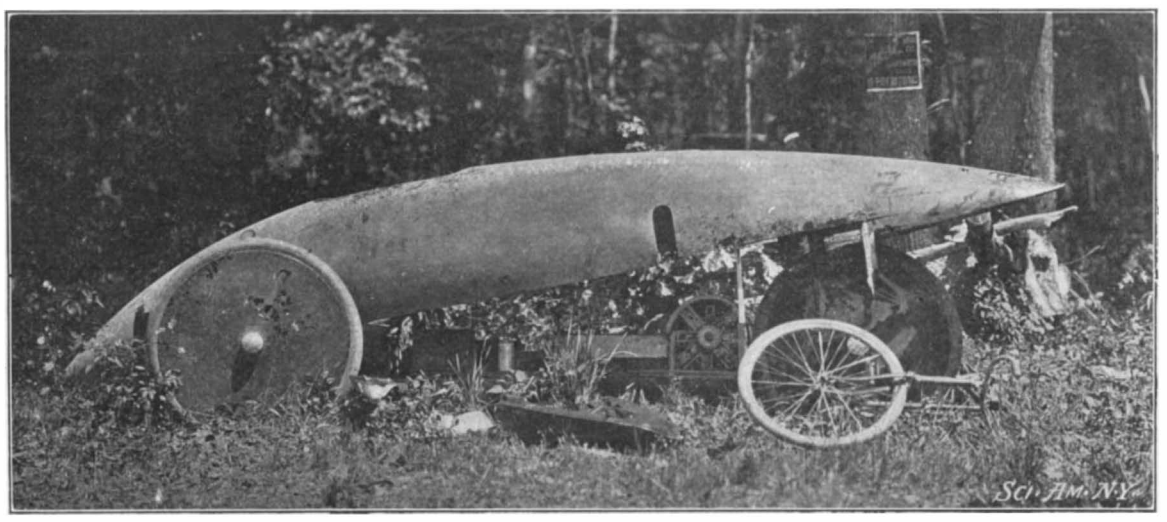
The machine was steered by a 7-inch hand wheel mounted on an inclined steering pillar, at the other end of which was a 4 or 5-inch drum. Three 3-16-inch transverse wire cables were wound once around this drum and had their ends fastened to horizontal bolts that passed through holes in two vertical uprights on the rod connecting the steering-head arms. The bolts were pressed outwardly by small, stiff springs, which were intended to keep the cables taut enough to properly steer the wheels.

Mr. Baker covered his racer with a light, torpedo-shaped superstructure of wood and black canvas, which completely hid the occupants of the car, who saw to steer through a small isinglass window. In order to minimize air resistance, even the wheels were covered with similar canvas or oil cloth.

The mile trials with the gasoline and steam machines had all been run off, and the latter were lined up for the kilometer speed tests, when the electric racer was started. The machine covered the kilometer, or the first six-tenths of a mile in 36 seconds, and was rapidly accelerating its speed. After making the one slight turn in the road which was just beyond the kilometer point, it was seen to swerve out to the opposite side. It then crossed the road again, reaching the opposite side near the hospital tent, after which it again swerved to the right and struck the trolley tracks. This caused it to bounce up in the air so much that apparently all four wheels left the ground. When they touched again the powerful band brakes had been applied, one of them probably tighter than the other, for the machine skidded and whirled sharply around, smashing broadside on into the crowd of spectators. It stopped in the position shown in the diagram, with its nose pointing in the direction from which it had come. The body was knocked off, but the two operators stepped out unhurt. The two outer wheels were demolished, but the inner ones, as will be seen from the photograph, were not damaged. This would indicate that the tremendous momentum the vehicle had attained threw it upon its two outer wheels as it whirled around.

The accident seems to have been due to two causes. First, the roadbed was not smooth enough for the speeds that were attempted, and second, the steering gear of the racer was not as positive as it should have been.

The Automobile Club of America has decided to hold no more road speed tests of automobiles in the future, and it is to be hoped that the energies of its members will be devoted to the development of pleasure and commercial automobilism with the same zest that they have shown in developing and patronizing the racing vehicles.



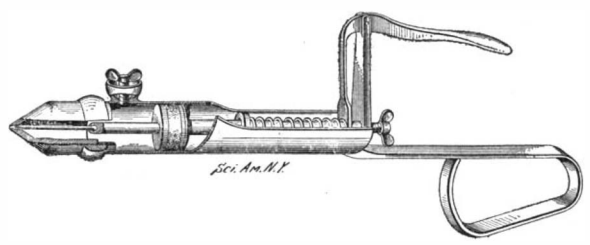
AFTER THE WRECK.

Prof. J. C. Bose read a paper at a meeting of the Linnean Society, on electric response in ordinary plants under mechanical stimulus, and performed a series of experiments showing electric response for certain portions of the plant organism, which proved that as regards fatigue, behavior at high and low temperatures, the effects produced by poisons and anæsthetics, the responses are identical with those hitherto held to be characteristic of muscle and nerve and of the sensitive plants. He drew the final conclusion that the underlying phenomena of life are the same in both animals and plants, and that the electrical responses which he had demonstrated are but the common physiological expression of these.

Patent Department

SOME RECENTLY PATENTED NOVELTIES.

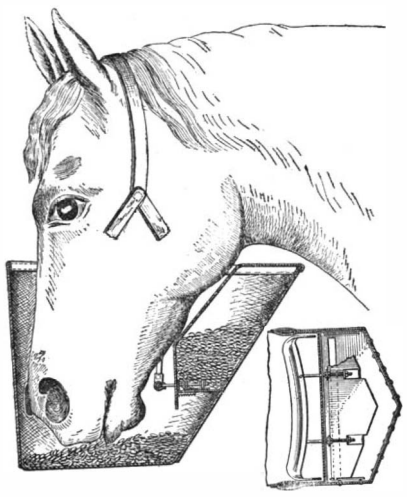
NEW SOLDERING IRON.—The tool here illustrated contains at its soldering end a reservoir of molten solder, which may be fed out at the option of the workman. The feeding device consists essentially of a plunger operated by a bellcrank against the tension of a coil spring. The plunger is mounted on a sleeve, through which passes an adjusting rod, threaded at the rear in



NEW SOLDERING IRON.

a stationary portion of the tool. A pin is connected to the other end of this rod by a knuckle-joint, and extends into the outlet opening of the solder reservoir. The amount of flow can be regulated by turning the adjusting rod, thus withdrawing or inserting the pin into the outlet opening. To fill the reservoir remove the plug at the top of the chamber, operate the adjusting rod to close the outlet, and then the solder may be poured into the reservoir through the cup-shaped inlet without fear of leakage.

FEED BAG.—At last the poor truck horse can eat his noon meal in peace. Mr. George Dale, of New York



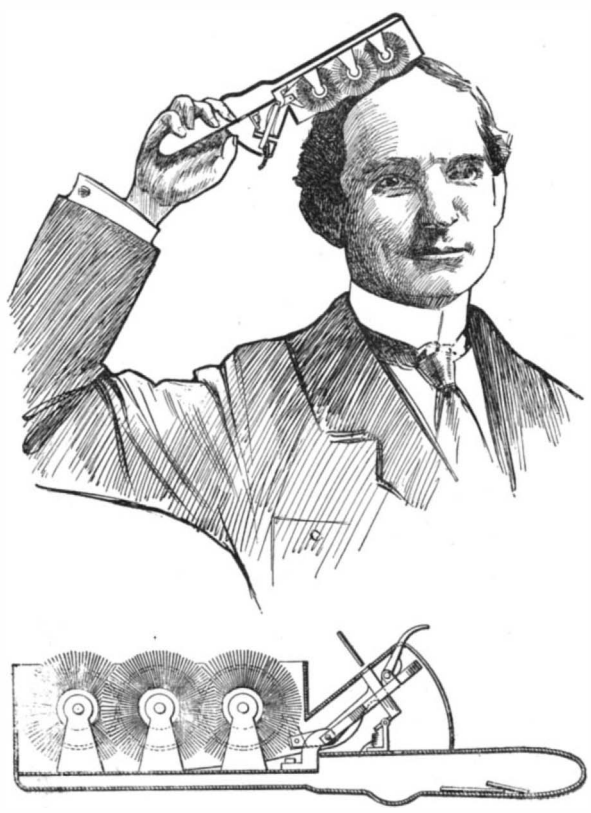
A NEW FEED BAG.

city, who has doubtless often observed the frantic efforts of a horse to reach the oats in his feed bag, is the inventor of a device which automatically regulates the supply of feed to the animal and brings the proper amount always within its reach.

A portion of the feed bag is partitioned off, and serves as a magazine for storing the feed. The oats are fed from this magazine by an escapment operated by the animal's jaw while chewing. A release bar is held by a spring against the lower jaw of the horse, and swings on straps at each side of the bag. Connection is made between this rod and a shutter, which, at every motion of the jaw, moves back and forth over an opening in the floor of the magazine and delivers a small quantity of feed to the animal. Means are provided for regulating the flow of the feed.

This arrangement compels the horse to eat slowly and prevents waste; for having a constant supply of food within reach the animal will not toss its head in an effort to catch the food "on the fly."

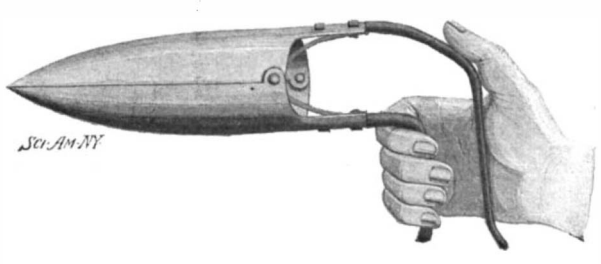
COIN-OPERATED HAIR-BRUSH.—A very novel idea has just been produced by Mr. Clarence M. Stiner, of New York city. He has designed a brush for use in public places—such as toilet rooms in public houses, railway cars, etc.—which at any time may be operated at a nominal expense to present a fresh, clean set of bristles for the user. As shown in the diagram, the bristles are radially attached to hubs forming wheels, and the wheels are connected by a gearing. On the handle portion of the hair-brush is a mechanism for rotating the brush wheels. This mechanism can be started only on the insertion of a coin, and its operation is as follows: When the coin is inserted it falls freely until arrested by a small detent at the bottom of the coin slot. The operator then depresses a thumb-lever until its inner end engages the coin and presses it into frictional engagement with the main lever. On the end of the main lever is a pawl which engages the gear teeth on the nearest brush wheel. Depression of the levers results in a partial rotation of the bristles, and the coin chute is depressed sufficiently to clear the detent referred to above. On release of the levers the coin is free to drop into a receptacle within the brush handle and the mechanism assumes its normal arrangement of parts.



COIN-CONTROLLED HAIR BRUSH.

PLANTER.

A very simple device is here shown which may be used for transplanting, inserting, and removing plants from the ground; also for inserting fertilizer with the plants or at the sides of the plant roots. The device consists of two jaws pivoted together and forming when closed a continuous round body tapering to a



A HANDY LITTLE PLANTER.

point and, therefore, adapted to be easily inserted in the ground. The handles which extend upward from each jaw are bent at right angles to the body and may be easily grasped in a single hand. Springs secured to these handles hold the jaws normally in closed position.

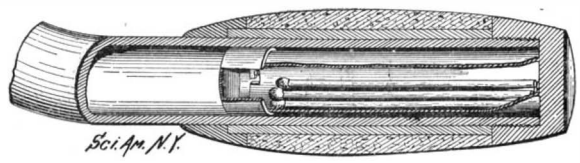
In using this device the plants may be placed therein when the planter is closed, and then after forcing the device into the ground the jaws are spread apart by pressure on the handles. Upon withdrawing the planter the plant will be left in the ground. It is obvious that at the same time of inserting a plant a fertilizer may be also inserted, or fertilizer alone may be inserted at the side of a plant or its roots. While other devices for this purpose have heretofore been made, they are usually much larger, being designed to be operated by two hands and requiring foot power for forcing them into the ground. This planter, on the contrary, is of convenient size for small plants and may be very conveniently carried about and easily operated. Mr. John J. Olinger, of 145 West 20th Street, New York city, has recently received a patent for this invention.

The most up-to-date thing in the way of street sprinklers is in use on the streets of Colorado Springs, Col. Here there is necessity for sprinkling the streets all the year round, and as the avenues are all unusually wide the proposition has always been a difficult one and a matter of serious expense. An electrical sprinkler has been recently put to work and its performances seem marvelous as compared with the machines which are more or less familiar to all. The use of the arm on one side of the machine is dispensed with entirely and the water is thrown from both sides at one time, and by the use of an electrical sprayer it is not only broken up into very fine particles but is thrown a great distance. The tank capacity is 2,600 gallons, and the vehicle is propelled by two 60 horse power motors. The sprinkling heads are in the center of the car on each side, and the water is forced from these by two individual force pumps operated by a 30 horse power motor and a street 120 feet wide can be watered from curb to curb. The amount of water thrown and the distance is under complete control at all times.

UTILIZING THE TUBE SPACE IN BICYCLE FRAMES.

Notwithstanding the hundreds of inventions on bicycles and their accessories in the past, there seems to be but little interruption in the present issue of bicycle patents. A new idea has evidently taken hold of the inventors, for noticeable among the latest improvements are an increasing number of devices for utilizing the chambers contained within the tube frame.

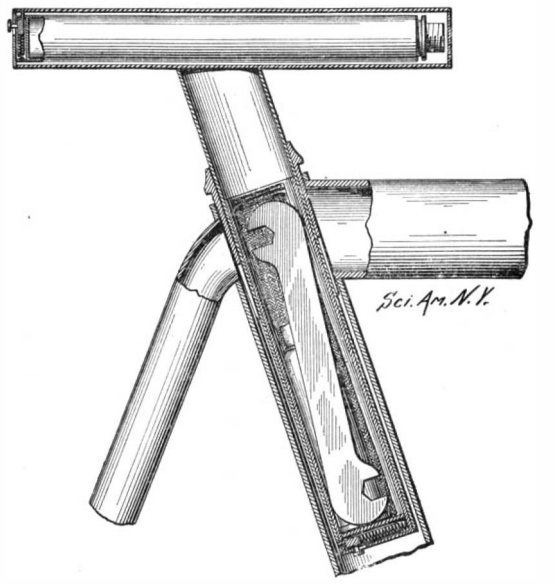
Our readers may possibly remember an article which appeared in our columns a few months ago, describing a bicycle lamp which burned gas generated within the hollow handle bars. We illustrate here a match safe which can also be put within this same space. The match safe is the invention of Mr. J. L. Held, of Bridgeport, Conn., and comprises a tube which, at one end, is integral with a cap piece threaded onto the handle bar, and at the other end is closed by a suitable cover.



THE HANDLE-BAR MATCH-BOX.

Matches can thus be securely kept and protected from the weather.

Two inventors in Canada make use of the seat-post of a bicycle for carrying tools, repair materials, etc. The receptacles consist of cylinders closed at their outer ends and held within the seat-post tubes by spring latches. In our illustration we show the horizontal receptacle as containing a bicycle pump, and in



THE CENTER BRACE USED AS A TOOL RECEPTACLE.

the upright chamber is a wrench and various repair materials.

Three Minneapolis inventors have hit on the novel scheme of inserting a piston into the upright tube which holds the saddle-post, thus forming a bicycle pump. In the first place, a rubber plug is tightly pressed into the lower part of the tube, in order to close it and serve incidentally as a cushion when engaged by the piston rod. Immediately above this plug is the nipple, to which is attached a rubber hose of sufficient length to reach the charging nipple of either tire. The upper end of the piston-rod projects from the top of the seat-post and is bent to form a handle. The advantages of this arrangement are obvious. The pump is always at hand when needed, and out of the way when not in use. It is larger and more powerful than any pump which could be conveniently carried

USING THE CENTER-BRACE AS A PUMP.

in a tool-bag or in one's pocket. While pumping, the operator has both hands free, for the machine forms the necessary support to the pump.

Brief Notes Concerning Patents.

President Louis W. Hill, of the Eastern Minnesota Railroad, son of James J. Hill, has turned his attention to the mechanical side of railroading, and associated with Max E. R. Toltz, a mechanical engineer of the Great Northern system, and has taken out a patent on a combined freight and oil car. It is said that the Standard Oil Company has agreed to use the cars of the new type.

We have coin-controlled machines for selling chewing gum, cigars, lead pencils, and candy; machines which require but the dropping in the slot of a nickel to enable one to listen to the latest "coon" songs; and machines that embody in their construction a city directory which can be opened by the dropping of a cent in the ever-present slot. In a word, the name of the "coin-controlled" machine is legion. The latest addition to the list is a coin-controlled newspaper-vending machine, which is the invention of Albert D. Smith, of St. Louis, Mo.

Lord Kelvin is busily engaged in compiling the specifications of two new patents. The completion and patenting of these devices will bring the number of patents controlled by the Kelvin syndicate to forty-nine, a large number of which deal with appliances which are now regarded as indispensable to the equipment of ships in every country of the world. The success with which the veteran physicist has exploited the commercial side of his inventions is shown by the circumstance that upon the latest warship added to the Japanese navy there are no less than fourteen Kelvin appliances.

A new method of treating copper ore has been devised by William J. Knox, of Edgewood Park, Pa. In the oxidation of an iron-bearing copper matte in a molten state, in a basic-lined vessel, little or no silica being present, Mr. Knox has found that there is formed a highly fusible compound of iron and sulfur—an oxysulfid of iron. Air is forced into the matte, thereby generating heat sufficient to maintain the mass in a molten state and causing the formation of iron oxysulfid under such conditions that substantially no silicate of iron is formed. The copper is separated by precipitation. The process, it will be observed, is somewhat similar to that of making Bessemer steel.

Prof. Charles Whitney Carmen, who has been connected with a number of Western educational institutions, is the inventor of a new electrical apparatus for the projection of pictures impressed on an opaque substance, onto a screen to be viewed by a number of persons simultaneously. This dispenses with the necessity of the special preparation of the lantern slide, as pictures of all kinds, and objects themselves, coming within the required dimensions, can be placed in the machine and shown in enlarged form on the sheet. This machine was recently shown before the members of the Chicago Electrical Association for the first time, and its work was regarded as entirely satisfactory.

Among the new designs in safes, there is one built especially for use in the offices of street railway companies. The usual method followed in receiving conductors' receipts is to have them turned over to a cashier, which necessitates the employment of two men, so that one will always be on duty, but with the use of the safe the services of one of these men is done away with. The safe is always open for the receipt of the conductor's bags, but at the same time its contents are protected from thieves. The safe has an opening on the top which is covered with a shield on a hinge and supplied with a handle for the purpose of raising it. As this is done a tray presents itself through the hole rising to a point just flush with the top of the safe. The conductors' returns are placed on this tray and the handle turned down with which the money passes through the hole into the interior of the safe.

A snow plow of extremely novel design has been at work during the past winter on the Delaware, Lackawanna & Western Railroad. It is supplied with a turntable device which permits its operation to be entirely independent of the regular railroad turntables. This is an advantage of no little importance, for it is often desired to limit the operation of a snow plow to one particular stretch of country, whereas with the old style of plow much time would be consumed in making the many necessary trips to the turntable, which may be many miles away. A turntable device is attached to the front of this plow, and when it is desired to head around and make the return trip the front of the plow is raised by means of compressed air cylinders, and then the truck is run back to the center of the car where there is a bolster with a center bearing to fit the truck and a number of wheels arranged in a circle to bear on the turntable track. The whole car is then balanced on this truck and is readily pushed around by the crew.

Legal Notes.

POTENTIAL DISCHARGER INFRINGEMENT.—On October 21, 1890, Anthony C. White obtained a patent for a potential discharger, which was later acquired by the Western Electric Company. The device patented consisted of an upper conducting-plate of carbon, electrically connected with the line to be protected, and provided with a perforation in its lower surface filled with a plug of some easily fusible alloy; a lower conducting plate of carbon electrically connected with the earth by wire; and a thin, dielectric, mica partition slotted in the middle opposite the fusible block and securely fastened between and in contact with the plate. The purpose of this combination is to protect telephone apparatus used in connection with electric currents and liable to be injured by high potential currents which occasionally intrude upon telephone and telegraph wires. The Kinloch Telephone Company made a device consisting of two plates of the same character electrically connected and used in the same way as the conducting plates of White—a silk dielectric partition between them; and two leaden poles or shot secured by wax, one in a perforation in the inner surface of the upper plate, and the other in a hole in the inner surface of the lower plate. The company was sued by the Western Electric Company for infringement. The primary court found that there was infringement. On appeal the Kinloch Company claimed that they did not use "easily fusible material," but leaden poles or shot which cannot be readily fused; and that, when attention is given to the parts which really do the work, the Kinloch device does not perform its function in the same way as the White device. The wax of the fusible material is not essential to the operation of the combination, but is a mere means of holding the parts of the device together; while the fusible material of White's is indispensable. The court found that a patentee who has made a definite claim has thereby disclaimed and abandoned to the public all other combinations and improvements that are not mere imitations of his own inventions; but that when he secures a patent for a new combination, he thereby necessarily claims and secures a patent for every mechanical equivalent of that combination, because in the light of the patent law, every mechanical equivalen of the device is the same thing as the device itself. It was here held that the wax or other fusible material which is held in perforations in the faces of the conducting plates until released by the heat of an arc between them, so that they are caused to run down between the plates and form a conducting link, are mechanical equivalents of White's fusible mass or plug, when they are used in a potential discharger for the same purpose and when they perform the same function.

COMBINATIONS OF OLD ELEMENTS.—The Western Electric Company has won still another action against the Kinloch Telephone Company; this time for the infringement of letters patent granted to John A. Seeley for an improvement in grouping steering-jacks and annunciators for multiple switchboards. Seeley's improvement relates entirely to the placing and grouping of switches or jacks and annunciators in a multiple switchboard system. When Seeley made his invention the annunciator commonly used was a shutter hinged at its lower edge, which shutter dropped and disclosed the subscriber's number when he took his telephone-receiver from its hook. Seeley's switchboard was divided into sections, each of which contained all the line-jacks of all the subscribers served by the entire board of annunciators, and steering-jacks of about two hundred of the subscribers. Before the Seeley invention, the line-jacks on a multiple switchboard performed the function of his steering-jacks. The essence of his invention was the convenient and uniform grouping of the annunciators and their corresponding steering-jacks relatively to each other. His invention was directed to the improvement of the service on a multiple switchboard to enable one operator to render more speedily and efficiently all the service required by the subscribers entrusted to her care. The combination was useful. It was immediately widely applied. While this fact is insufficient in itself to sustain a patent where the machine or combination is clearly without novelty, yet where the question of novelty is fairly open under the law, the fact that a patented device and combination has displaced others which had previously been used to perform its function, and has gone into immediate and general use, is persuasive evidence that it involved invention.

The defendants, instead of placing all the line-jacks of all their subscribers on the same multiple switchboard, divided their subscribers into four equal parts or divisions, called divisions A, B, C and D. All the annunciators and all the steering-jacks of all the lines of the Kinloch Company are distributed in corresponding groups upon the sections of each of the four boards, so that each group of annunciators and its corresponding group of steering jacks occupy the same uniform relative position to one another on each section of each of the boards. The court said that this uniform grouping is the principle of Seeley's invention. The essence of Seeley's invention is the uniform correspondence and relative position of all and not of a part of the members of groups of annunciators and steering-jacks, so that, given a place in a group of steering-jacks corresponding with an annunciator in one group of annunciators, every steering-jack corresponding with an annunciator in the same place in the other groups, will be found in the same relative position in every corresponding group of steering-jacks. This uniform correspondence in the relative positions of the groups and the members of which they are composed, the defendants preserved.

OMISSION OF AN ELEMENT IN COMBINATION.—A most unusual situation was presented in the case of the American School Furniture Company vs. J. N. Sauder Company (113 Fed. Rep. 576) for the consideration of the Circuit Court of the Eastern District of New York. Although the complainants charged the infringement of a patent, the defendants admitted that the patent was for a useful invention and that it had not been anticipated, contrary to the customary practice in patent litigation. The only issue was infringement; and even upon this point the defendants took no testimony, relying wholly upon the alleged weakness of the plaintiff's case. The Court found on examination of the evidence that the defendant's course was justified and that the charge of infringement was not made out.

The patent in the suit, in the opinion of the court, is in no sense a primary patent. It covers improvements in adjustable school desks and seats, and consists, says Judge McPherson, in the combination of old elements. The defendants omitted one of the elements of a combination forming the subject of certain claims, and had substituted no equivalent. It has been held time and time again that nothing in the law of patents is more firmly settled than the rule that a claim for a combination is not infringed if any one of the described or specified elements be omitted without the substitution of anything equivalent thereto. In the present case the Court followed this well-established rule and dismissed the complainant's bill.

UNFAIR COMPETITION.—The liability of corporations for torts in pursuance of an alleged conspiracy to ruin the business of a competitor was the subject discussed in an unfair business competition case (West Virginia Transportation Company vs. Standard Oil Company, 40 S. E. Reporter, 591) in which an opinion was recently handed down by the West Virginia Court of Appeals. It was held that one may, without liability, in furtherance of his own interest in the competition of business, establish any business in competition with another and may induce customers of that other to withdraw their patronage in order to obtain the business for himself, although it injure, and is intended to injure, the other person's business, provided there is no contract between such other person and the customers. The motive of the person so doing, though malicious, is not material, if his acts are lawful. The court cites the case of the farmer who dug a hole, cutting off underground water which used to percolate and ooze through lands of a neighbor. It was held that the farmer was not liable, though he did the act with malice, for he had the right to use his land as he pleased

WESTINGHOUSE AIR-BRAKE IN COURT.—The Boyden patent, 481,134, owned by the Westinghouse Air Brake Company, has again come up for consideration in a United States Court. The patent in question formed the subject of a most hotly contested litigation decided before the Supreme Court, by whom a most careful examination of the state of the art was made at the time. The patent, therefore, did not come up again in the present case (Westinghouse Air Brake Company vs. Christensen Engineering Company, 113 Fed. Rep. 594) with such presumption of validity only as arises from its issue by the Patent Office. The decision of the Supreme Court in the previous case, expressed with no uncertain sound, was, therefore, accepted by Judge Lacombe as establishing the position that Boyden was an independent and meritorious inventor, who solved with great ingenuity and in the simplest manner the problem of providing a quick-acting air-brake valve. The plaintiffs' motion for preliminary injunction was sustained.

The Pressed Steel Car Company has secured a Court order compelling its former chief engineer, John Hansen, to assign certain inventions and patents to them. The company claims that he was paid $10,000 a year and had contracted to make over all improvements to them. The patents claimed by the company were secured in 1901.

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

POTENTIAL-REGULATOR.—R. A. PHILIP, Seattle, Wash. In a constant-potential circuit for the distribution of electricity it is necessary to keep the average potential of the different mains as nearly constant as possible. The customary way of doing this is to select some particular point which is assumed to be a fair representative of the average condition of the circuit and from this point to run pilot-wires back to an indicating device at the station. In this invention, however, a group of pilot wires are used in such a way that instead of presenting the potential at some particular point the voltage indicated is proportionate to the average at several points of the system. This minimizes the liability of the general potential being injuriously affected by local disturbances.

TELEPHONE-CIRCUIT.—G. E. GOODHEAD, Winchester, Ill. The circuit is so arranged as to practically prevent a party at an intermediate station from hearing the conversation between parties at other instruments. By a simple arrangement the released receiver-hook automatically changes the circuit, cutting out the instrument on the line in a direction opposite to central and forming the circuit from the ground through the telephone box to the central.

COLLECTION-RECORDING MECHANISM.—G. F. DE GROOT and I. L. THOMPSON, Morristown, N. J. The device provides for recording at a post-office the collection of mail matter from the street boxes. The mechanism is electrically controlled and operates upon the opening of a letter-box to record on a strip of paper the number of the collector, the number of the box, and the date and hour of collection. Provision is made for locking and releasing the letter-box door at stated intervals.

Engineering Improvements.

SPARKING PLUG.—C. A. MEZGER, Brooklyn, N. Y. This sparkling plug is so arranged as to prevent sooty formations within the cylinder of an internal combustion engine from accumulating around the sparkling points in such manner as to short-circuit the igniter. The parts are so arranged that the current would have to make a long path through the soot in order to effect a short circuit, which, owing to the poor conducting qualities of the soot, would be practically impossible.

Machines and Mechanical Devices.

CIGARETTE-MACHINE.—J. C. HANSEN-ELLEHAMMER, Istedgade 99, Copenhagen, Denmark. This invention affords a new device for filling the cigarette tubes in a cigarette-machine with tobacco. The filling is effected by screwing into the cylinder a thin, screw-shaped wire, then by means of this wire introducing the tobacco-cylinder into the paper tube, and finally unscrewing said wire from the completed cigarette. The movement of the device is capable of such adjustment that the wire may be introduced even in finely cut tobacco without in any way damaging the tobacco-cylinder.

BURGLAR-ALARM FOR SAFES.—I. J. EMORY, Waverly, Ohio. Means are provided for automatically sounding an alarm when any unauthorized person approaches the safe with the object of surreptitiously opening the same. A protected passageway to the door of the safe is provided, also means for holding the devices inoperative during business hours, or when the alarm-actuating mechanism is to be set in condition for service.

XYLOPHONE-PLAYER.—F. R. GOOLMAN, Binghamton, N. Y. The purpose of the invention is to provide a mechanism for playing on xlyophones which may be relied upon to perform the functions for which it is intended. In order to play a xlyophone properly it is necessary to strike the bars of the instrument one stroke for short notes, and a succession of strokes for sustained notes. This mechanism is so constructed that such results will be invariably obtained when required.

TOOL-HOLDER.—C. F. PRESTON, Chicago, Ill. This tool-holder is especially designed for use in lathes, planers, and other metal-working machines. It is arranged to adjustably hold a cutting tool with an even bearing on the top and bottom to prevent undue vibration and render the tool as solid as an ordinary forged-steel tool. The tool is held without the use of set screws or other objectionable projections.

Railway Contrivances.

PROCESS OF RECONSTRUCTING RAILROAD-RAILS.—V. T. LYNCH Chicago, Ill. This invention enables the ordinary flanged rail to be cheaply transformed into a grooved rail without taking it up from the tracks. The edge of the flange is first swaged or upset, and metal is then run into a mold which extends along the flange of the rail and into which the flange projects, so that when the mold is removed the rail is left with a second tread running alongside the ball of the rail and forming a groove therein.

Vehicles and Their Accessories.

VEHICLE-BODY.—J. E. and C. B. BROWN, Bradford, Pa. The invention provides an improved construction for a vehicle-body which is adapted to greatly strengthen the body where the parts are secured together, and also dispenses with the use of screws and short plugs usually employed for the attachment of parts of the body, which frequently become loose or produce defacement of the finished exterior of the body.

WAGON-BODY.—J. W. FINCH, Leland, Miss. The invention relates to improvements in separable wagon bodies. The body consists of two parts which can be readily and with ease taken apart by one person, leaving the bottom resting on a running gear; thus adapting the vehicle to purposes where a box-like body could not be used to the same advantage.

DUMPING VEHICLE.—H. F. SHEPARD, Brooklyn, N. Y. Mr. Shepard has invented a dumping-wagon which is provided with an inclined bed-frame down which, when released, the body will slide by gravity to dumping position. A simple means is provided for releasing the tail-board from the body while dumping.

HORSE-HOPPLE.—M. KLEIN, Denver, Colo. This device, which is of simple construction, is designed to be carried by a horse and forms an effective means by which a horse may be instantly stopped or checked should he attempt to run away when used in harness or under saddle. The hopple may also be used as a hitching device so as to hitch a horse without the use of a hitching-post or weights.

Miscellaneous Inventions.

SLEEVE-HOLDER.—H. G. CARPENTER, Westbend, Iowa. The sleeve-holder is in the form of a spring-band or clasp for preventing sleeves of shirts, coats, or other light garments from slipping on the arm of the wearer. The edges of the band are provided with a series of notches which catch and hold the shirt more securely than would be practicable with a band having smooth edges.

COVER FOR TUMBLERS OR OTHER VESSELS.—F. L. JOBSON, Richmond, Va. The object of this invention is to provide a simple and effective cover for cups, goblets, tumblers, etc., which will effectually cover the same, and prevent ingress of air, odors, dust, germs, insects, etc., and which at the same time serves the purpose of a spoon-holder.

ARMOR.—J. J. PINDAK, Chicago, Ill. Mr. Pindak has invented an improved armor for the sides of war vessels, turrets, and other devices to be protected against projectiles. The armor is of such construction as to be readily applied or removed and is so arranged as to break the force of the projectile and distribute the impact over a large area.

STIRRUP.—W. H. AUGHEY and W. CLIFTON, Billings, Mont. The stirrup permits a quick and convenient change adjustment whereby it may be raised or lowered to suit different riders and also be readily adjusted to throw the weight imposed upon it either upon the ankles of the rider or away from them.

BASKET HANDLE.—M. TUCKER, Brocton, N. Y. The invention relates to a handle for baskets, particularly those used for grapes and like food, which not only serves as a means for carrying the basket, but also as a clamp for holding the top in place.

NON-REFILLABLE BOTTLE.—J. ZANGEL, Battlecreek, Mich. The neck of the bottle is provided with a casing having a valve. A spring normally holds the valve closed, and a weighted ball having flexible connection with the valve is employed to open the same on tilting the bottle.

RUBBER BOOT OR SHOE.—J. L. PERRY, Auburn, R. I. The heel portion is strengthened or re-enforced to such an extent as to prevent the bending down, and doubling up, and the consequent breaking of the heel back, as so frequently happens with rubber boots and shoes now made.

TOY OR GAME APPARATUS.—C. H. BUXTON, Neenah, Wis. The device not only affords amusement but also provides practice in digital dexterity. It involves two round rods, hinged together and so arranged that upon certain manipulation the ball may be caused to roll up the rods when inclined.

RECOIL PAD FOR GUNS.—J. R. WINTERS, Clinton, Mo. The invention is an improvement in recoil pads for guns, and has for an object to simplify such constructions, to avoid any substantial length of the stock, and to provide a novel arrangement of the filling tube by which the pneumatic pad is filled, as well as to provide a cover for the pad.

DISPLAY DEVICE.—J. K. ONEY, Huntington, W. Va. Mr. Oney affords an improvement in display devices, being in the nature of a simple construction which can be readily applied to a window or door frame to support an arm or bar for carrying a sign or other indicating means for advertising or like purposes.

TOBACCO-PIPE.—A. K. BOWMAN, Pittsburg, Pa. The pipe is provided with a woven tube through which the smoke passes and which will divide up the smoke into fine particles to collect from it the suspended poisonous substances; this will also cool the smoke. Any liquid that accumulates in the stem or mouthpiece will be absorbed by pads provided for that purpose.

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Inquiry No. 2710.—For dealers in stamped or pressed wooden mouldings.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2713.—For dealers in band steel and who are engaged in tempering small light springs.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 2714.—For makers of power cider mills.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2715.—For machinery for grading road-beds for steam railway construction.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2716.—For manufacturers of aluminium trade checks.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 2717.—For stamping machines for door plates, marks, etc.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 2718.—For manufacturers of hammer break sparkers for gasoline engines.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 2719.—For dealers in rubber tires for baby carriages.

PATENT FOR SALE.—Setting instrument patented March 18, 1902. Every machinist needs one. Used for different purposes. Send for circular. Morris Chamberlain, Bartley, N. J.

Inquiry No. 2720.—For manufacturers or dealers in indurated fiber goods.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 2721.—For dealers in lanterns with round globes, burning acetylene gas.

Inquiry No. 2722.—For dealers in electric fans run by a wet battery.

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Inquiry No. 2725.—For makers of hardware suitable for the manufacture of screen doors and windows.

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Inquiry No. 2737.—For manufacturers of steam riding galleries.

Inquiry No. 2738.—For machinery for making brackets and pins for telephone lines.

Inquiry No. 2739.—For the firms who make the felt covering for the United States government canteens.

Inquiry No. 2740.—For manufacturers of plates of aluminium.

Inquiry No. 2741.—For machinery for making horn combs.

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Inquiry No. 2745.—For manufacturers of ear tubes, etc.

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Inquiry No. 2747.—For makers of hollow copper or brass wire.

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Inquiry No. 2749.—For makers of paper rims or tires for placing over iron wheels.

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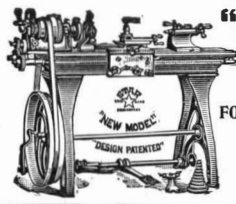
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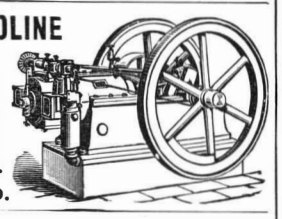
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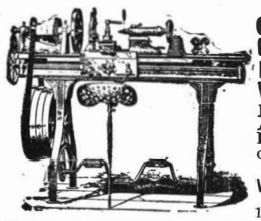
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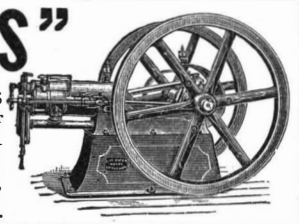
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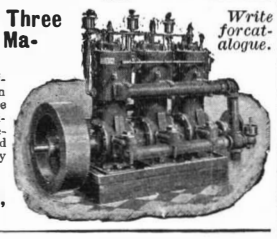
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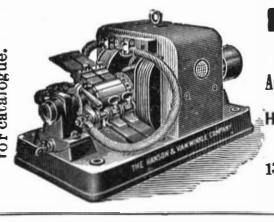
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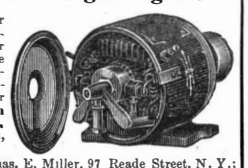
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VELOCITY DIAGRAMS. THEIR CONSTRUCTION AND THEIR USES. By Charles William MacCord, A.M., Sc.D. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1901. 8vo. Pp. iii-116. Price $1.50.

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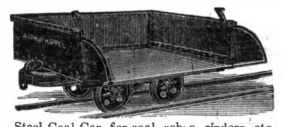

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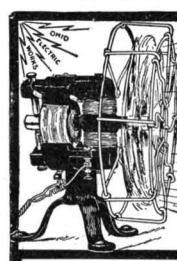

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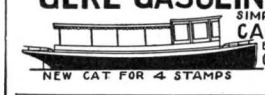

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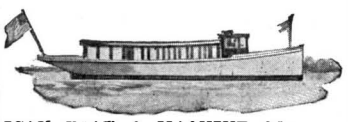

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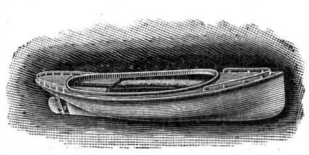

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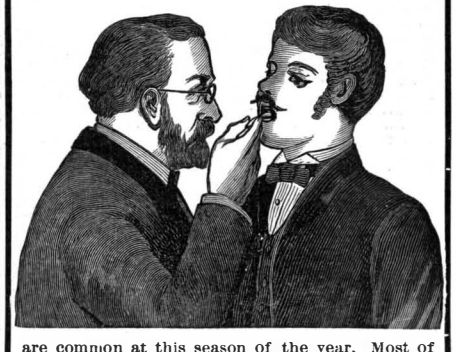

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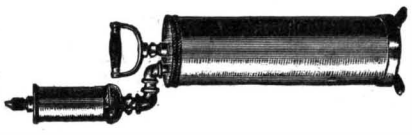

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(8621) E. C. S. asks: What causes cast iron to shrink near the hub of a casting which is cored for an inch hole? The shrink does not show outside, but when the hole is bored out shows itself, and upon breaking the casting a shrink hole is found from 1 to 2 inches in diameter. The walls of the shrink hole are light blue in color, and the iron is soft. Anything that you could suggest in regard to preventing it will be gratefully received. A. Cast iron shrinks to a considerable extent in setting from the fluid state. The outside surface next the sand sets first; the core, being dry, heats quickly, and the metal sets last near the central part of a hole core and draws away from it. The remedy is to make a riser near the place where the greatest shrinkage occurs, large enough to drop a rod of iron in, to keep the metal from setting by jumping the rod up and down and pouring hot metal into the riser, even if some of it runs over. In this way large wheel hubs are cast solid.

(8622) J. D. writes: I would like a formula for copper plating on metals (dip process); pickle for treating metals to remove scale, etc., before dipping; can silver or its imitation be deposited on metals by a similar process or by heat, as tin or zinc? A. Copper Deposits by Dipping: This is seldom practiced except on iron, as deposits thus obtained are generally wanting in lasting qualities, since, from the thinness of the coating, the iron is but imperfectly protected from atmospheric influences. If the iron is dipped in a solution of sulphate of copper 3½ oz., sulphuric acid 3½ oz., water 1 to 2 gal., it becomes covered with a coating of pure copper, having a certain adhesion; but should it remain there a few minutes, the deposit becomes thick and muddy, and does not stand any rubbing. Small articles, such as pins, hooks and nails, are thus coppered by tumbling them for a few moments in sand, bran, or sawdust impregnated with the above solution, diluted with three or four volumes of water.—Cleansing Cast Iron: Cast iron is freed from grease, etc., by dipping in hot alkali solution used for a similar purpose with copper, and after rinsing thoroughly is pickled in water containing about 1 per cent of sulphuric acid for several hours; then rinsed in water and scoured with fine sharp sand or pumice and a fiber brush. It is then rinsed and returned to the acid pickle for a short time, rinsed again and put into the plating bath directly. If more than 1 per cent of acid is used in the pickle the time of immersion must be shortened, otherwise the iron will be deeply corroded, and the carbon which the metal contains, and which is not affected by the acid, will not yield without a great deal of labor to the sand and brush.—Silver Solution for Dipping: Nitrate of silver 6 drms, cyanide potassium 1¼ oz., water 1 quart. Dissolve the silver and cyanide crystals each in one pint of water and mix. Warm in porcelain vessel to 180 deg. Fah. for dipping.

(8623) N. F. asks: Kindly inform me how many 16 candle power 110-volt lamps are there to the ampere on a single-phase alternating current; also, how many 16 candle power 110-volt lamps are there to the kilowatt on an alternating current; also, on a direct current, or do they both constitute the same as far as kilowatts are concerned? I know they do not constitute the same as far as amperes are concerned. A. Incandescent lamps are rated by the number of watts they consume per candle, and not by the amperes nor by the kind of current used to light them. The resistance of the lamp hot is made such that a determined number of volts will force current enough through the filament to raise it to a white heat. The usual rated number of watts is from 3 to 4 per candle. Since watts are the product of amperes by volts, it follows that the amperes used in any lamp vary with the voltage of the current. With direct current the voltage is usually about 110, and a 16 candle lamp consumes about 55 watts on the average, which requires about one-half an ampere per lamp. With an alternating current 52 or 104 volts are more commonly found in the distributing wires from the transformers for interior use. The amperes will therefore be somewhat higher in the lamp used upon a direct current, and volts are the same for both electric current.

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